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ABSTRACT

Legislators and community leaders have the responsibility to develop policies and make informed decisions to ensure that new technologies will enhance, and not frustrate, learning. That is why Congress established the Web-based Education Commission that for the past year has been chairing an effort exploring ways in which the Internet is changing the delivery of education. This report reflects the cumulative work of the Commission and a consensus of its findings. The Commission was able to identify the key barriers that are preventing the Internet from realizing its full potential for enhancing learning. Based on findings, the Commission issues a call to action in this report to: make powerful new Internet resources, especially broadband access, widely and equitably available and affordable for all learners; provide continuous and relevant training and support for educators and administrators; build a new research framework of how people learn in the Internet age; develop high quality online educational content that meets the highest standards of educational excellence; revise outdated regulations that impede innovation and replace them with approaches that embrace anytime, anywhere, any pace learning; protect online learners and ensure their privacy; and sustain funding via traditional and new sources that is adequate to the challenge at hand. The report is divided into three main sections: "The Power of the Internet for Learning," "Seizing the Opportunity," and "Moving from Promise to Practice: A Call to Action." The second section is further divided according to the following: "Access to Broadband Technologies: Bridges Across the Digital Divide"; "Professional Development: How Technology Can Enhance Teaching"; "Correcting a Paucity of Research and Development"; "Compelling Online Content"; "Removing Regulatory Restrictions to E-Learning"; and "Privacy, Protection, and 'Safe Streets.'"; and "Funding for e-Learning: A Continuing Challenge". Sections one and two include both illustrative stories that demonstrate how the Internet is being used in education. Appendices include: Commission Legislative Authority; Commission Meetings; Commission Hearings and Witnesses; e-Testimony Submissions to the Commission; Commission, Speeches and Presentations; Stakeholder Meetings with Commissioners and Staff; Individuals and Groups Providing Services to the Commission; and Commission Staff. (AEF)

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THE POWER OF THE INTERNET FOR LEARNING

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Moving from Promise to Practice

REPORT OF THE WEB-BASED EDUCATION COMMISSION TO THE PRESIDENT AND THE CONGRESS OF THE UNITED STATES

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REPORT OF THE
WEB-BASED EDUCATION COMMISSION

DECEMBER 2000

THE POWER OF THE INTERNET FOR LEARNING:

MOVING FROM PROMISE TO PRACTICE

Senator Bob Kerrey
Chair

Representative Johnny Isakson
Vice Chair

Washington, DC

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An effort as far-reaching as that taken on by the Web-based Education Commission could not have been possible without the invaluable assistance of many talented individuals. Ericka Miller, legislative assistant to Sen. Bob Kerrey and Glee Smith, legislative director to Rep. Johnny Isakson, provided continuous advice, support, and thoughtful review throughout our work. Claudia Pharis-Weiss, chief of staff to Rep. Chaka Fattah; Carmel Martin, senior policy advisor to Sen. Jeff Bingaman; and Raissa Geary, legislative assistant to Sen. Michael B. Enzi, also made significant contributions.

In addition, we wish to acknowledge the tremendous efforts of several others: Web site experts Vickie Bender and Paulette Palladino, as well as Julie Smoragiewicz of the South Dakota School of Mines and Technology; A. Lee Fritschler, Maureen McLaughlin, Linda Roberts, and Jay Noell of the U.S. Department of Education; Tricia Fitzgerald of Sun Microsystems, Inc.; Claudia Huff, Tom Horton, and Patricia Bartlett of the Georgia Institute of Technology; Cheryl Lemke of the Metiri Group; Michele Blair of Compaq Computer Corporation; and the students in the Technology and Education Department classes taught by professors Anna Hillman and Patti Abraham at Mississippi State University.

Finally, the Commission is deeply grateful to the hundreds of individuals and organizations that participated in our yearlong hearings, meetings, and proceedings; provided us with live and online testimony; and assisted us in developing a comprehensive report.

THE POWER OF THE INTERNET FOR LEARNING:
MOVING FROM PROMISE TO PRACTICE

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FOREWORD

The Internet is a powerful new means of communication. It is global, it is fast, and it is growing rapidly. Reaching to the far corners of the earth, the Internet is making the world at once smaller and more connected, transmitting information at nearly real-time speed. An estimated 377 million people are currently using the Internet, only half of whom are in the United States. The World Wide Web is bringing rapid and radical change into our lives—from the wonderfully beneficial to the terrifyingly difficult.

For education, the Internet is making it possible for more individuals than ever to access knowledge and to learn in new and different ways. At the dawn of the 21st Century, the education landscape is changing. Elementary and secondary schools are experiencing growing enrollments, coping with critical shortages of teachers, facing overcrowded and decaying buildings, and responding to demands for higher standards. On college campuses, there is an influx of older, part-time students seeking the skills vital to success in an Information Age. Corporations are dealing with the shortage of skilled workers and the necessity of providing continuous training to their employees.

The Internet is enabling us to address these educational challenges, bringing learning to students instead of bringing students to learning. It is allowing for the creation of learning communities that defy the constraints of time and distance as it provides access to knowledge that was once difficult to obtain. This is true in the schoolhouse, on the college campus, and in corporate training rooms.

The power of the Internet to transform the educational experience is awe-inspiring, but it is also fraught with risk. As legislators and community leaders, we have the responsibility to develop policies and make informed decisions to ensure that new technologies will enhance, and not frustrate, learning. That is why Congress established the Web-based Education Commission.

For the past year we have been chairing an effort that has explored the ways in which the Internet is changing the delivery of education. Along with Senators Jeff Bingaman and Michael Enzi, Representative Chaka Fattah, and a distinguished group of education and business leaders, the Commission has heard about the tremendous power of the Internet to empower individual learners and teachers. We have also heard about the barriers that frustrate learning in this new environment. Our witnesses urged us to "think big" as we addressed the challenges of a rapidly changing educational landscape.

The report we are now submitting to the President, to Congress, and to the nation reflects the cumulative work of our Commission and a consensus of our findings. It is a call to action to all of those who must be involved if we are to implement real and positive change—policymakers at the federal, state, and local levels; students and educators; parents; communities; and the private sector. No one group can bring about this change alone.

The Internet is a promising tool. Working together, we can realize the full potential of this tool for learning. With the will and the means, we have the power to expand the learning horizons of students of all ages.

Bob Kerrey

SENATOR
BOB KERREY
Chair

Johnny Isakson

REPRESENTATIVE
JOHNNY ISAKSON
Vice Chair

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EXECUTIVE SUMMARY

Although web-based education is in its earliest phase, it holds extraordinary promise.

The bipartisan, congressional Web-based Education Commission set out to discover how the Internet is being used to enhance learning opportunity for all learners from pre-kindergarten through high school, at postsecondary colleges and universities, and in corporate training.

In the course of our work, we heard from hundreds of educators, policymakers, Internet pioneers, education researchers, and ordinary citizens who shared their powerful visions and showed us the **promise of the Internet—**

To center learning around the student instead of the classroom

To focus on the strengths and needs of individual learners

To make lifelong learning a practical reality

We heard that the Internet enables education to occur in places where there is none, extends resources where there are few, expands the learning day, and opens the learning place. We experienced how it connects people, communities, and resources to support learning. We witnessed how it adds graphics, sound, video, and interaction to give teachers and students multiple paths for understanding. We learned that the Web is a medium today's kids expect to use for expression and communication—the world into which they were born.

And we were told first-hand that the Internet could result in greater divisions between those with access to the opportunities of web-based learning, and those without access.

We also understood that the Internet is not a panacea for every problem in education.

By the end of our work, we were able to identify the key barriers that are preventing the Internet from realizing its full potential for enhancing learning. The Commission was urged to help the nation better understand these barriers and offer its recommendations for addressing them.

Based on the findings of our work, the Commission believes a national mobilization is necessary, one that evokes a response similar in scope to other great American opportunities—or crises: Sputnik and the race to the moon; bringing electricity and phone service to all corners of the nation; finding a cure for polio.

Therefore, the Commission is issuing a call to action to:

- **Make powerful new Internet resources, especially broadband access, widely and equitably available and affordable for all learners.** The promise of high quality web-based education is made possible by technological and communications trends that could lead to important educational applications over the next two to three years. These include greater bandwidth, expansion of broadband and wireless computing, opportunities provided by digital convergence, and lowering costs of connectivity. In addition, the emergence of agreement on technical standards for content development and sharing will also advance the development of web-based learning environments.

- **Provide continuous and relevant training and support for educators and administrators at all levels.** We heard that professional development—for preK-12 teachers, higher education faculty, and school administrators—is the critical ingredient for effective use of technology in the classroom. However, not enough is being done to assure that today's educators have the skills and knowledge needed for effective web-based teaching. And if teacher education programs do not address this issue at once, we will soon have lost the opportunity to enhance the performance of a whole generation of new teachers, and the students they teach.

- **Build a new research framework of how people learn in the Internet age.** A vastly expanded, revitalized, and reconfigured educational research, development, and innovation program is imperative. This program should be built on a deeper understanding of how people learn, how new tools support and assess learning gains, what kinds of organizational structures support these gains, and what is needed to keep the field of learning moving forward.

- **Develop high quality online educational content that meets the highest standards of educational excellence.** Content available for learning on the Web is variable: some of it is excellent, much is mediocre. Both content developers and educators will have to address gaps in this market, find ways to build fragmented lesson plans into full courses and assure the quality of learning in this new environment. Dazzling technology has no value unless it supports content that meets the needs of learners.

- **Revise outdated regulations that impede innovation and replace them with approaches that embrace anytime, anywhere, any pace learning.** The regulations that govern much of education today were written for an earlier model in which the teacher is the center of all instruction and all learners are expected to advance at the same rate, despite varying needs or abilities. Granting of credits, degrees, availability of funding, staffing, and educational services are governed by time-fixed and place-based models of yesteryear. The Internet allows for a learner-centered environment, but our legal and regulatory framework has not adjusted to these changes.

- **Protect online learners and ensure their privacy.** The Internet carries with it danger as well as promise. Advertising can interfere with the learning process and take advantage of a captive audience of students. Privacy can be endangered when data is collected from users of online materials. Students, especially young children, need protections from harmful or inappropriate intrusions in their learning environments.

- **Sustain funding—via traditional and new sources—that is adequate to the challenge at hand. Technology is expensive, and web-based learning is no exception.** Technology expenditures do not end with the wiring of a school or campus, the purchase of computers, or the establishment of a local area network. These costs represent just the beginning.

The issue before us now is how to make good on the Internet's power for learning and how to move from promise to practice.

The Web-based Education Commission calls upon the new Congress and Administration to embrace an "e-learning" agenda as a centerpiece of our nation's federal education policy.

This e-learning agenda should be aimed at assisting local communities, state education agencies, institutions of higher education, and the private sector in their efforts.

The moment is at hand.

We urge the new President and the 107th Congress to seize this opportunity and to focus on ways in which public law can be modified and changed to support, rather than undermine, the technology that is so dramatically changing education.

- **We call on federal and state governments to make the extension of broadband access for all learners a central goal of telecommunications policy.**

  We urge federal and state officials to adopt a policy framework that will help accelerate broadband deployment in education quickly and effectively. The E-rate program, which has brought 21st Century telecommunications into the nation's schools and libraries, has provided a dramatic boost. Individual state efforts have shown promise and success. Local and state policymakers should consider complementary efforts focused on educational applications of broadband access.

- **We call upon policymakers at all levels to work with educational institutions and the private sector to support the continuous growth of educators through the use of technology.**

  We encourage continuing federal and state support for initiatives and models that make just-in-time, just-what's-needed training and support available to educators. The reauthorization of the Elementary and Secondary Education Act and subsequent Higher Education Act reauthorization offer the opportunity to make this happen and to incorporate the best thinking and practices identified by this Commission. Partnerships that bring together the federal government, state and local agencies, the private sector, and educational institutions offer the best promise of assuring continuing teacher empowerment and growth with technology.

- **We call upon the federal government to create a comprehensive research, development, and innovation framework for learning technology.**

  We recommend establishing a benchmark goal for federal research and development investment in web-based learning, consistent with similar benchmarks in other industry segments. This framework would focus on high payback targets of educational opportunity and support the creation of learning communities and tools for collaborative knowledge building and dissemination among researchers, teachers, and developers.

- **We call upon the public and private sectors to join forces in developing high quality content and applications for online learning.**

  At the federal level, the Commission recommends that Congress articulate content development priorities, provide seed funding for high need areas, and encourage collaboration and partnerships between the public and private sectors in the development and distribution of high quality online materials. The federal government should work with all agencies and programs to adopt technical standards for the design of online courses, meta tagging of digital content, and universal design standards for access for those with disabilities.

  The Commission recommends that the education community develop standards for high quality online courses. The current voluntary system of accrediting higher education institutions and programs should continue but with better clarity for the consumer regarding online options. The Commission recommends the convening of state and regional education accreditors and organizations to build common standards and requirements for online learning programs, courses, and certifications comparable to the standards required for onsite programs.

- **We call upon Congress, the U.S. Department of Education, and state and regional education authorities to remove barriers that block full access to online learning resources, courses, and programs while ensuring accountability of taxpayer dollars.**

  The Commission encourages the federal government to review and, if necessary, revise the "12-hour rule," the "50 percent rule," and incentive compensation requirements that are creating barriers to students enrolling in online and distance education courses.

  The Commission encourages national, state, and regional education policymakers to increase cross-state regulatory and administrative cooperation in web-based education. We also call upon states to develop common and appropriate policies regarding credits, faculty compensation, accreditation, licensing, articulation, student services, and programs to reach underrepresented student populations.

  The Commission endorses the U.S. Copyright Office proposal to convene education representatives and publishers to build greater consensus and understanding of the "fair use" doctrine in its application to online learning.

- **We call upon parents, the education community, and the private sector to develop and adopt privacy and protection safeguards to assure that learners of all ages are not exploited while participating in online learning activities.**

  The Commission believes that filtering and blocking software alone is of limited value. Instead, we recommend encouraging developers and educators to collaborate in creating noncommercial, high quality educational "safe zones" on the Web. We also recommend that schools, districts, and states develop and promote programs for the safe, wise, and ethical use of the Internet.

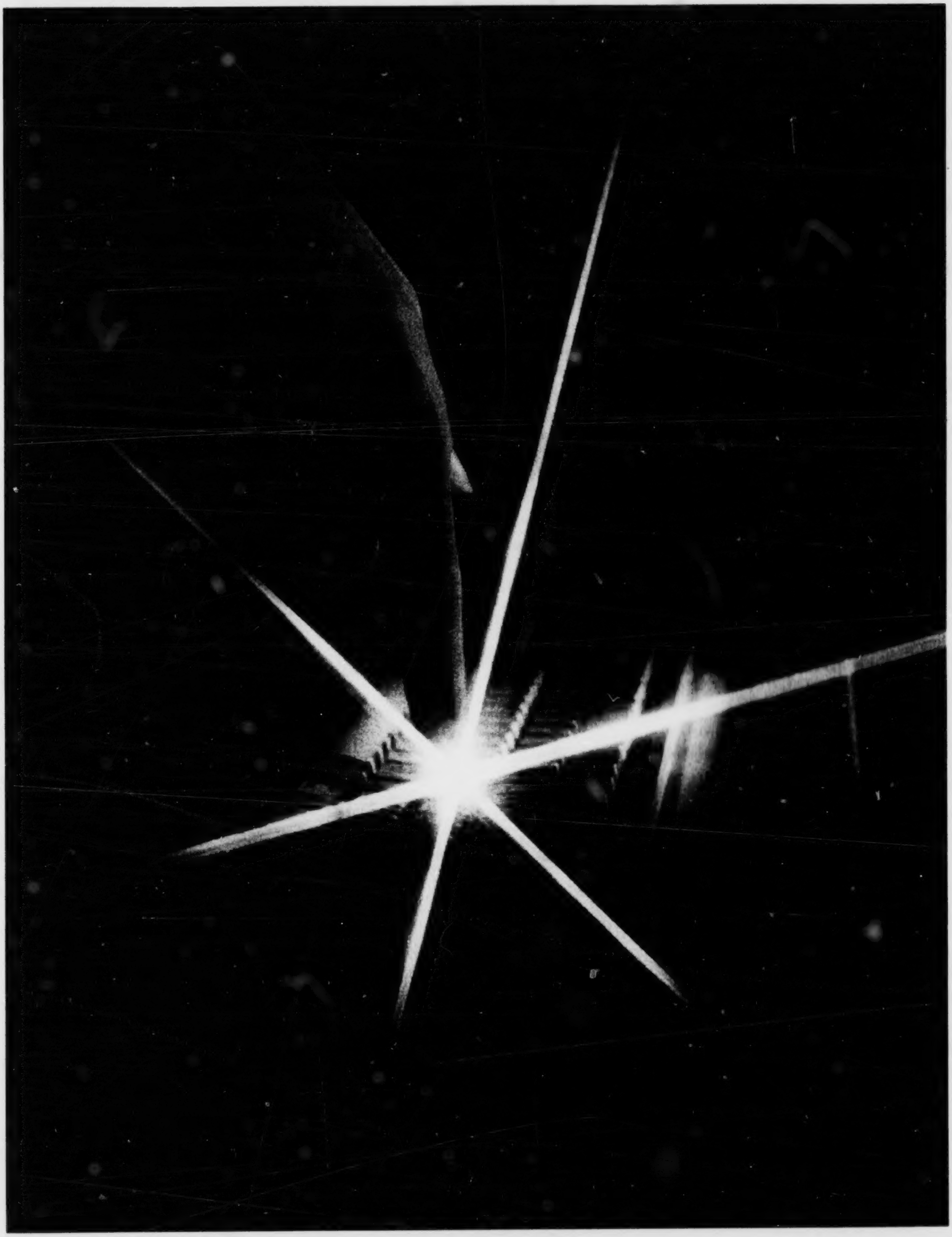
  The Commission also believes some adjustments to the Children's Online Privacy and Protection Act may be necessary to allow educational exemptions for the collection of identifiable student data online with appropriate parental consent.

- **Finally, we call upon the federal government, states, localities, and the private sector to expand funding initiatives and to develop new models to bring these policies to reality.**

  The Commission believes these initiatives could include tax incentives, additional public-private partnerships, increased state and federal appropriations, and the creation of a learning technology trust fund. The Commission encourages states and localities to aggregate their market strength as a way of bringing advanced technologies to education at a considerably lower cost.

The question is no longer *if* the Internet can be used to transform learning in new and powerful ways. The Commission has found that it can. Nor is the question *should* we invest the time, the energy, and the money necessary to fulfill its promise in defining and shaping new learning opportunity. The Commission believes that we should. We all have a role to play.

It is time we collectively move the power of the Internet for learning from promise to practice.



THE POWER OF THE INTERNET FOR LEARNING

The Internet is perhaps the most transformative technology in history, reshaping business, media, entertainment, and society in astonishing ways. But for all its power, it is just now being tapped to transform education.

The good news is that the Internet is bringing us closer than we ever thought possible to make learning—of all kinds, at all levels, any time, any place, any pace—a practical reality for every man, woman, and child.

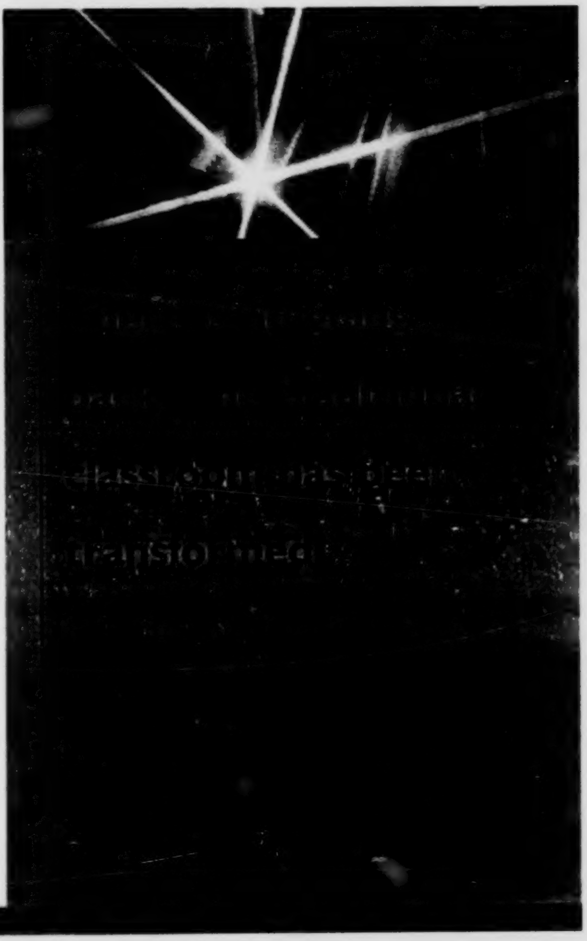
The bad news? Millions still cannot access the Internet and do not understand how to use it to harness the global web of knowledge.

They do not know how to deal in information, the basic currency of the knowledge economy. They do not know how to find information, how to handle it, how to trade in it, how to invest it for their futures.

These individuals, already at risk, will become increasingly marginal in the emerging knowledge economy—unless we change current law, current regulations, and current practices.

The World Wide Web is a tool that empowers society to school the illiterate, bring job training to the unskilled, open a universe of wondrous images and knowledge to all students, and enrich the understanding of the lifelong learner.

The opportunity is at hand. The power and the promise are here. It is now time to move from promise to practice.



THE CURRENT CONTEXT FOR K-12 EDUCATION[4]

- **Growing enrollments.**
  The baby boom echo, the 25% increase in the nation's birthrate that began in the mid-1970s and peaked in 1990, and rising immigration have increased school enrollment.[5] Public elementary and secondary school enrollment is projected to reach over 47 million in 2000, and to increase further in subsequent years.[6]

- **Critical need for teachers.**
  Schools across the nation will need to hire between 1.7 and 2.7 million additional teachers over the next decade to meet the demand of rising enrollments and replace a large pool of retiring teachers.[7]

- **Overcrowded schools and outdated buildings.**
  $127 billion in spending is needed to repair, renovate, and modernize school buildings. The average public school in America is 42 years old.[8]

Age-Old Dreams, Down-to-Earth Problems

Amidst all of the hype about the Internet is the reality of its inevitability. Forged by the competitive struggles of the private sector, it will soon surpass today's expectations like a Ferrari overtaking the Model-T.

Web-based education is just beginning, with something of far greater promise emerging in the middle distance. Yet technology, even in its current stage of development, can already allow us to realistically dream of achieving age-old **goals in education—**

To center learning around the student instead of the classroom

To focus on the strengths and needs of individual learners

To make lifelong learning a reality

Blazing Trails

The bipartisan, congressional Web-based Education Commission set out to discover how the Internet is being used to enhance learning opportunity, and to identify ways that Congress and the President can help local schools, state education agencies, and postsecondary institutions overcome barriers.

Our work began with face-to-face hearings across America and in virtual hearings on the Web. The Commission listened to hundreds of people eager to show how the Internet and learning are coming together to meet the needs of their communities and schools. From the Head Start teacher on an Indian reservation, to the governor of South Dakota, to the superintendent of a challenged inner-city school district, to the Secretary of the U.S. Army, they gave us a vision of the tremendous promise of the Internet, and they demonstrated its power.[1]

And we listened to those who are concerned about preserving the most valuable elements of traditional education delivery as we move ahead in developing web-based courses and models.

What did they tell us? They told us that the Internet offers education in places where there is none and extends resources where few exist. They told us that the Internet connects people, communities, and resources to support learning. They told us that it extends the learning day and the learning place. They showed us how it adds graphics, sound, video, and interaction to give teachers and learners multiple paths for understanding. And they told us the Web is a media today's kids expect to use for expression and communication—the world into which they were born.

We also learned that the most important ingredient is not money. It is the presence of a local hero or heroes with the vision, courage, and stamina to challenge the status quo. Absent this ingredient, more money will be of little benefit.

The Commission listened to people facing problems as varied as all of America. The solutions they created were no less diverse. Every person who testified before us had one thing in common: each was an Internet trailblazer who heard the cries of need in their communities, and responded—crafting solutions that best fit local outlooks and expectations.

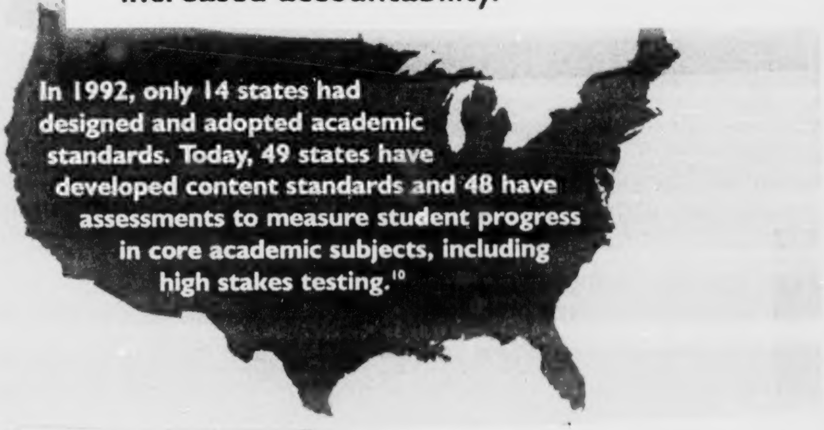
Each saw an opportunity and took it. Each accepted risk. Each embraced a challenge. For these reasons, we believe these Internet trailblazers are among the new heroes of education.

K-12

- **Increasingly diverse student population.**

35% of U.S. children are members of minority groups, a figure that is expected to climb more than 50% by 2040. One in five comes from a household headed by an immigrant. And nearly one-fifth live in poverty.[9]

- **Intense focus on higher standards and increased accountability.**



In 1992, only 14 states had designed and adopted academic standards. Today, 49 states have developed content standards and 48 have assessments to measure student progress in core academic subjects, including high stakes testing.[10]

More alternatives to public education.

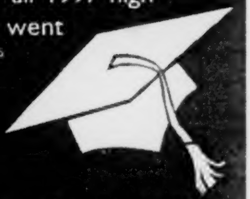
As of fall 1999, 350,000 students were enrolled in more than 1,600 charter schools across the United States. Thirty-six states and the District of Columbia have passed charter schools legislation.[11] Home schooling is growing. The number of home schooled 6-17 year olds in 1994 was 345,000, growing to 636,000 by 1996.[12] This figure is now estimated to be between 700,000 and 1.5 million.[13]

* Note to Readers: Throughout this report we use the term K-12 to refer to the traditional U.S. elementary, middle, and secondary school structure. Much of the data cited was collected at the kindergarten through grade 12 level. However, we acknowledge that web-based technologies have value for young children at the pre-kindergarten level as well (i.e., ages 3 and 4) and occasionally, we use the term preK-12.

CURRENT CONTEXT FOR POST-SECONDARY EDUCATION

POST
SECONDARY

- **Growing enrollments.**
Total college enrollment has been increasing in recent years, projected to hit a record 15.1 million in fall 2000. Between 1998 and 2010, full-time enrollment is projected to increase by 22% as large numbers of high school graduates enter college. Part-time enrollment is projected to increase by 16%.[14] About 67% of all 1997 high school graduates went directly on to college.[15]



- **Increased levels of education are required for our knowledge-based economy.**
Higher levels of skills and knowledge are required for an economy based on information. 85% of current jobs require education beyond high schools, up from 65% in 1991.[16]

- **Changing demographics.**
Large numbers of older persons, working adults, and part-time students attended college in 1999. The adult age cohort is the fastest growing segment of students in postsecondary education: 77 million adults are estimated to be taking postsecondary courses. Despite rising enrollments noted above, just 16% of college students fit the traditional 18-22 year old profile, attend full-time, and live on campus.[17]

A Call to Action

These leaders identified distinct barriers to web-based education, and urged us to remove them. They told us the promise of the Internet could not be fully realized unless there is:

- **Greater access to broadband connectivity**
- **Guidance in the best uses of the Web for learning**
- **Understanding of how people learn differently with the Internet**
- **Content that leverages the powerful capabilities of the Web**

We also heard their frustrations. They informed us that yesterday's regulations stymie innovation. They warned us that the Internet is still uncharted territory and urged us to assure that appropriate protections are put in place. And they emphasized that without new sources of funding the promise of the Internet for learning may not be met.

Above all, they asked us to issue a national call to action to remove these barriers.

What Are We Waiting For?

Against this backdrop of opportunity, there are some that have called on us to hold back. In essence, they seek a moratorium on the educational use of digital technologies, including the Internet, until clear evidence of their effectiveness and shortcomings are better understood.

We believe that this call, if heeded, would squander a momentous opportunity in education. This Commission believes that we have sufficient evidence to know that the Internet—if used wisely—enhances education.

We know it works. It is an empirical success in schools, and an empirical success in the private sector.

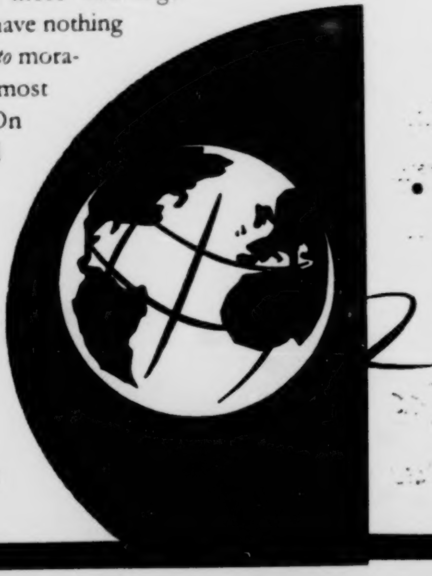
Imagine what would have happened if the nation's corporate leaders had imposed a similar moratorium in 1990, before they were able to measure objectively any positive impact of technology investment in productivity. It took years for these technological investments to bear fruit. Fortunately, business made these investments in technology. As vast as those investments were, they are dwarfed by their results—a one-third increase in real U.S. economic growth.[2]

We live in a global market, one in which a strained U.S. labor market has to import brainpower and high-skilled workers, or rent it over the Internet from people living in Dublin or Mumbai. In such a rapidly changing environment, standing still is not an option.

Those in the educational sector who would have us wait fail to grasp what has been obvious to the private sector for half-a-decade. The Internet is not a fad. It is not just another in a long line of technologies that have promised a "quick fix" for education. Its reach and impact on all aspects of society are unprecedented. The interactivity of this new technology makes it different from anything that came before. It elicits participation, not passive interest. It gives learners a place for communication, not isolation.

It is not a new form of television. It is the beginning of a new way of learning.

In one sense, however, those who urge education to hold back have nothing to worry about. A *de facto* moratorium already exists in most American schools. On average, U.S. firms spend between $3,500 and $5,500 per worker in technology and technological support each year,[3] compared to per student spending on technology that rarely exceeds a couple hundred dollars in the best of circumstances.[4]



POST SECONDARY

- **Rising costs of higher education.**
  College costs have risen at both public and private institutions. In the last decade, average tuition and fees at public colleges have risen 44%, and the average at private colleges shows a 40% increase after adjusting for inflation.[18]

- **New technologies are transforming postsecondary institutions.**
  Students enrolled in distance education as a percentage of total postsecondary enrollments are projected to triple to almost 15% in 2002 from just 5% in 1998.[19] The number of distance courses offered by postsecondary institutions and the number of enrollments nearly doubled between 1994-95 and 1997-98.[20]

- **Privatization in higher education.**
  The profit-making sector sees education as an investment opportunity. A growing number of for-profit institutions are emerging and providing students with alternatives to public education.

- **Globalization.**
  The demand for U.S. higher education by students abroad is huge. Close to 500,000 foreign students currently study in the U.S.. Global demand for higher education is forecast to reach 160 million students in 2025.[21]

At the beginning of the 21st Century, the most cutting edge tool to be found in many American classrooms—including our institutions of higher education—is still an overhead projector.

No Turning Back

The Commission has found:

The need for a new design in learning is there. Today's education is built on an agrarian model that worked in the years when we were a nation of farmers, foresters, and fishermen. Schooling changed to take on elements of the industrial revolution (factory-line classes, assembly-line curriculum, and teacher-foremen) that worked for the needs of the Industrial Age. New designs are needed to create the "knowledge workers" who will define the Information Age.

The market is there. Business is poised to support education with powerful Internet solutions. We know that education itself can be a strong market that drives the innovation of continuing products, tools, and applications to benefit learners across the spectrum.

The global economy is there. If this era of globalization has proven anything, it is that a growing world economy can create a strong and lasting demand for skilled knowledge workers and a technologically savvy workforce.

But we haven't made the connection to education. We must seize the opportunities and complete these connections—technological and human.

And we must advance with constant assessment and reflection. There is still much about learning and the impact of technology we do not know. We must continue to research what is not known, analyze what is proposed or underway, and then examine the results. We also must combine our belief in the great value of these advances with appreciation for the difficulties that we face: the inequality of access and the lack of teacher preparedness for web-based learning.

To make the most of learning with the Internet, we will have to address serious issues. Many of these issues are not new. They have been facing education for decades, and some are reaching a crisis point.

We cannot talk about effective use of the Internet in education without understanding the parts of the system that are already strained: teacher shortages and

MEDIA AND INFORMATION: THE WORLD OF TODAY'S STUDENTS

- **Data smog: explosion of information and sources. Kids need information literacy.**
- **Media sensitization and expectations: kids expect content to be as exciting as their latest video game. How can schools compete?**
- **Information architecture: information can be structured in new ways to support effective searching, use, and understanding.[22] How do students learn this?**

TECHNOLOGY TRENDS

Moving from:	Moving to:
narrowband	broadband
plain, single mode (e.g., text or speech)	multimodal rich connectivity
tethered (wired) access	untethered (wireless) access
users adapting to the technology	the technology adapting to the user

the need for better preparation and retraining; teacher compensation and the need to provide a more professional work environment; inequalities in school funding; aging school buildings; and poor student performance. We heard how these strains are slowing the full deployment of the Web for learning. Addressing these issues is essential.

In short, the Internet is not a panacea for every problem in education. We need to be realistic. But we also must realize that the Internet is a tool that can help us empower every student and elevate each individual to new levels of intellectual capacity and skill. That is the great opportunity of this new technology.

Such a promise is easily made. It will take a greater commitment to keep.

THE CURRENT CONTEXT FOR WORKFORCE TRAINING IN THE INFORMATION ECONOMY

- **Increased demand for skilled workers.** Skilled jobs now represent 85% of all jobs, in contrast to 20% in 1950. Between 1998 and 2008 more than 2 million new skilled information technology (IT) workers will be needed to fill newly created jobs and to replace workers leaving the field. By 2006 nearly half of all workers will be employed in industries that produce or intensively use information technology products and services.

- **Shortage of skilled workers.** In 1999 nearly 720,000 IT positions went unfilled. The escalating demand for skilled workers in information technology has led to a lifting of the number of visas for high tech workers from 115,000 to 195,000. The demand for high tech labor in Silicon Valley alone is fully one third greater than the current high tech workforce nationwide.

- **Need for continuous training.** It is estimated that 50% of all employees' skills become outdated within 3 to 5 years. To deal with this, corporate training budgets have increased 23.5% between 1994 and 1999.

- **Shift to use of web-based training for workers.** Classroom use in corporate training is expected to drop from the current level of 78% to 64% by 2001. The market for web-based corporate learning is expected to reach $11.4 billion by 2003, up from $550 million in 1998.

- **Growth in corporate universities.** In the last thirteen years the number of companies that have opened corporate universities grew from 400 to 1,800. 40% of Fortune 500 companies have established corporate universities. At the current rate the number of corporate universities will exceed the number of traditional universities by the year 2010.

E-EDUCATION IS BIG BUSINESS NOW—AND WILL BE BIGGER IN THE FUTURE:

- **Education and training is the second largest sector of the U.S. economy. At approximately $815 billion, it represents the nation's second largest expenditure, behind healthcare. The education market currently represents approximately 9% of the gross domestic product.[37]**

- **The K-12 e-learning market is estimated at $1.3 billion and is expected to grow to $6.9 billion in 2003.[38]**

- **The postsecondary online market is estimated at $1.2 billion and it is expected to grow to $7 billion by 2003.[39]**

- **The U.S. corporate e-learning market is estimated at $1.1 billion and it is expected to grow to $11.4 billion by 2003. The global market for e-learning is estimated at $300 billion and is expected to grow to $365 billion by 2003.[40]**

- **Venture capital funding in knowledge enterprises amounted to over $3 billion since January 1999 or about triple the total invested in the previous nine years.[41]**

22

ARMING SOLDIERS WITH LAPTOPS

The 21st Century U.S. Army needs soldiers educated for high tech warfighting and other vital missions. These are soldiers, says Secretary of the Army Louis Caldera, who are comfortable with "a network-centric battlefield," one "where command, control, communication, intelligence, and situational awareness are accomplished digitally and shared instantaneously across the battlefield."

The Army also needs help recruiting and retaining soldiers who are eager to learn new skills and earn a degree. Until now, however, the Army has had difficulty delivering high levels of quality education to soldiers stationed around the world.

Many soldiers take university-based courses while serving, but the costs tend to be high and scheduling difficult. And soldiers rotate locations—a collection of courses from several different institutions may make for a well trained soldier, but may not add up to a full-fledged degree.

The Army is responding by launching a major initiative to educate soldiers through a program called the Army University Access Online[1]—a $600 million effort based on laptops and "anywhere, anytime" learning principles.

The Army's commitment to distance learning is expected to expand the market for online content and courses, creating incentives for development.

Secretary Caldera believes this new Army initiative will address three vital issues. It will help recruiting. It will improve learner retention. And it will help produce the educated, Information Age soldiers America needs to succeed in the missions and battlefields of tomorrow.

The Army expects to build the largest online educational portal in the world with the objective of enabling any enlisted Army personnel to earn a postsecondary degree or technical certification. To help in this effort, soldier-students will receive tuition assistance, textbooks, laptops, help-desk support, Internet access, academic counseling, extensive course selection, and a command climate that encourages life-long learning.

The Army anticipates that within the first three months of the program 15,000 to 20,000 soldiers will be enrolled and pursuing degrees or professional credentials. The vision for Army University is that eventually every one of the Army's one million soldiers will be able to take advantage of the program.

The Army's commitment to distance learning is expected to expand the market for online content and courses, creating incentives for development. This should, in turn, create a much richer set of offerings for online learners in the civilian sector as well.

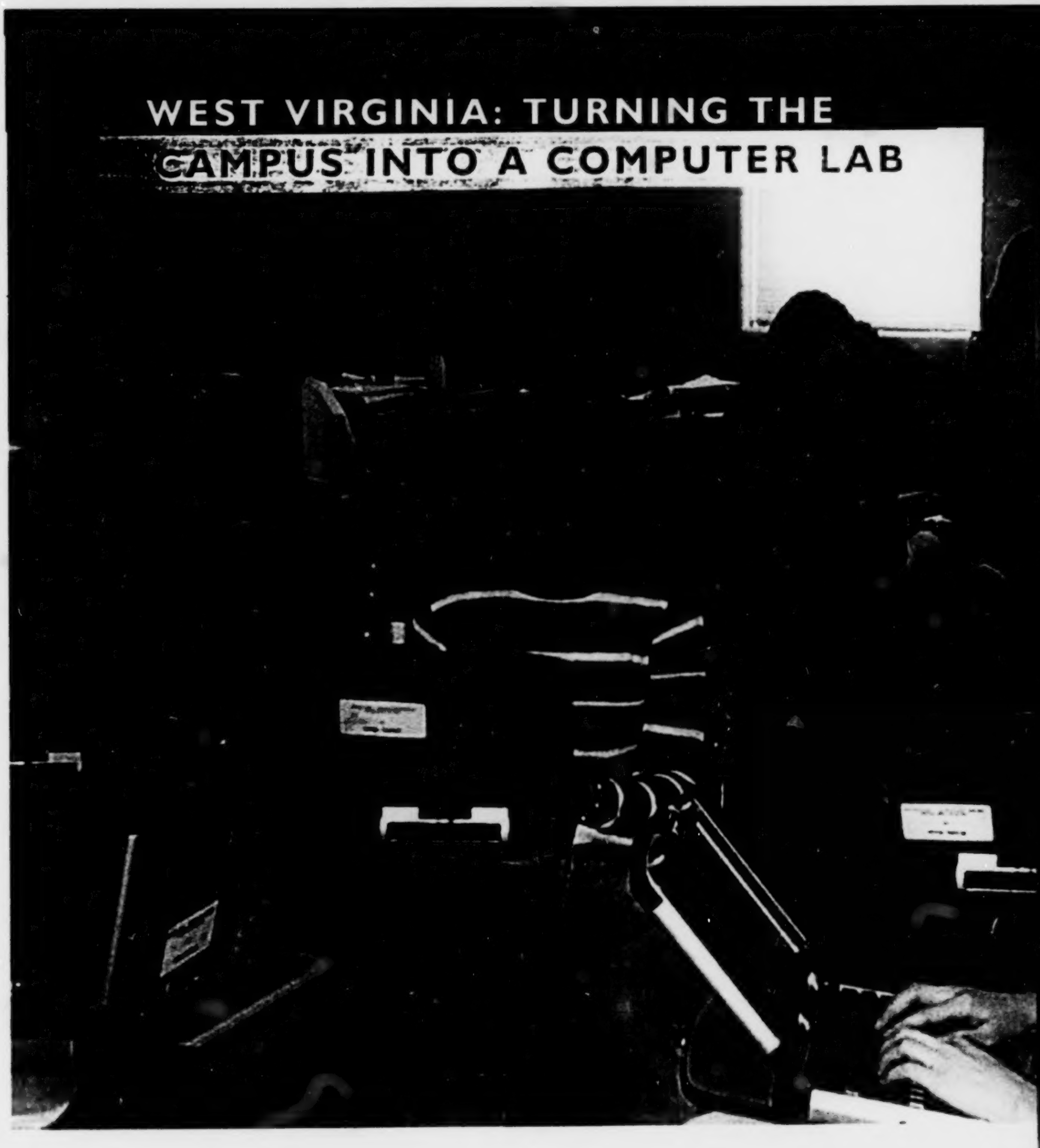
Secretary Caldera says that giving adults a "learn while you serve" option will attract more quality recruits. It is an incentive with high-payback potential. Once soldiers are finished with their service, they will return to civilian life with strong educational credentials and a valuable set of marketable workforce skills.

The program is also expected to improve retention, as more soldiers achieve their personal education goals without leaving the Army.

"It is difficult to articulate the enormous impact that this initiative will have on enlisted soldiers," says Army Sergeant Major Jack L. Tilley. "I can tell you that Army University Access Online is exactly what today's soldiers are looking for—a chance to earn their degrees while they serve. By helping soldiers achieve their personal, professional, and educational goals Army University Access Online reinforces the Army's commitment to investing in its people."

[1] See http://eARMYU.com

WEST VIRGINIA: TURNING THE CAMPUS INTO A COMPUTER LAB



The "Digital Divide" takes many forms. Students in Wetzel County,[1] West Virginia, are geographically remote from big city life, and, until recently, school libraries—with out-of-date collections—constituted the main information resource.

School Superintendent Martha Dean realized that web-based learning could transform the academic opportunities and broaden horizons for her students. She wanted to build on the technology program West Virginia had put into place in the elementary schools. But she knew her high school students needed to go beyond the basic skills approach and transition to the self-directed learning activities they would need later in life.

Dean chose the learning approach offered by NETSchools, which gives every student and teacher a laptop connected to a Local Area Network through infrared ports installed in each room. Once every student has a laptop and the infrared ports are in place, the entire campus becomes, in effect, a computer lab. Students can connect in hallways, the cafeteria, and the library as well as in class.

"I never thought it would be possible that kids would give up their free lunchtime to learn," says teacher Darlene Mihalee. "It is not unusual to go down there and see kids with a sandwich in one hand and a keyboard in the other."

Infrastructure was only the beginning.

The school's T-1 connection meant everyone could surf the Web and find information. For Scott McGlumphy, a so-so student before the shift to connected laptops, Web access turned him into a student with a keen interest in anthropology and top grades. "No knowledge is now out of reach," Scott says. "Our imagination is our only limit. And there are billions of sites out there, almost like billions of different worlds you can visit."

Special education students learned to navigate the Web to plan a vacation trip and make reservations. Agricultural students use their laptops to operate the school's commercial greenhouse, enter data in the field, and follow research on plant and animal diseases.

After only six months, 80 percent of Hundred High students were accessing the Internet daily. Test scores went up. Over the course of that first year the 144 students at Hundred High scored higher and ranked above the national mean in every subject, as well as total basic skills, on the Stanford Achievement Test (SAT 9).

Dean is grateful to Congress for the funds her district received through the E-rate program, but she says that a restriction on home use of E-rate funds creates problems for students. She is seeking additional funds and modes of connection so that students can continue to dial-in from home. She is also concerned about teacher training, as well as how to provide both educational and technical support. Dean believes that higher education institutions need to step in and change their teacher preparation programs, so all new teachers have strong technological skills.

Dean also calls for a new teaching outlook.

"I believe that curricular revision must occur. Basic skills must be expanded to include the use of the computer and the Internet to accomplish the goal of enhancing a student's capacity to access, record, analyze, and report information," Dean says. "Students who lack access to technology and the Web will become the second-class citizens of the future."

Thanks to the district's efforts, the students of Wetzel County have soared across the Digital Divide.

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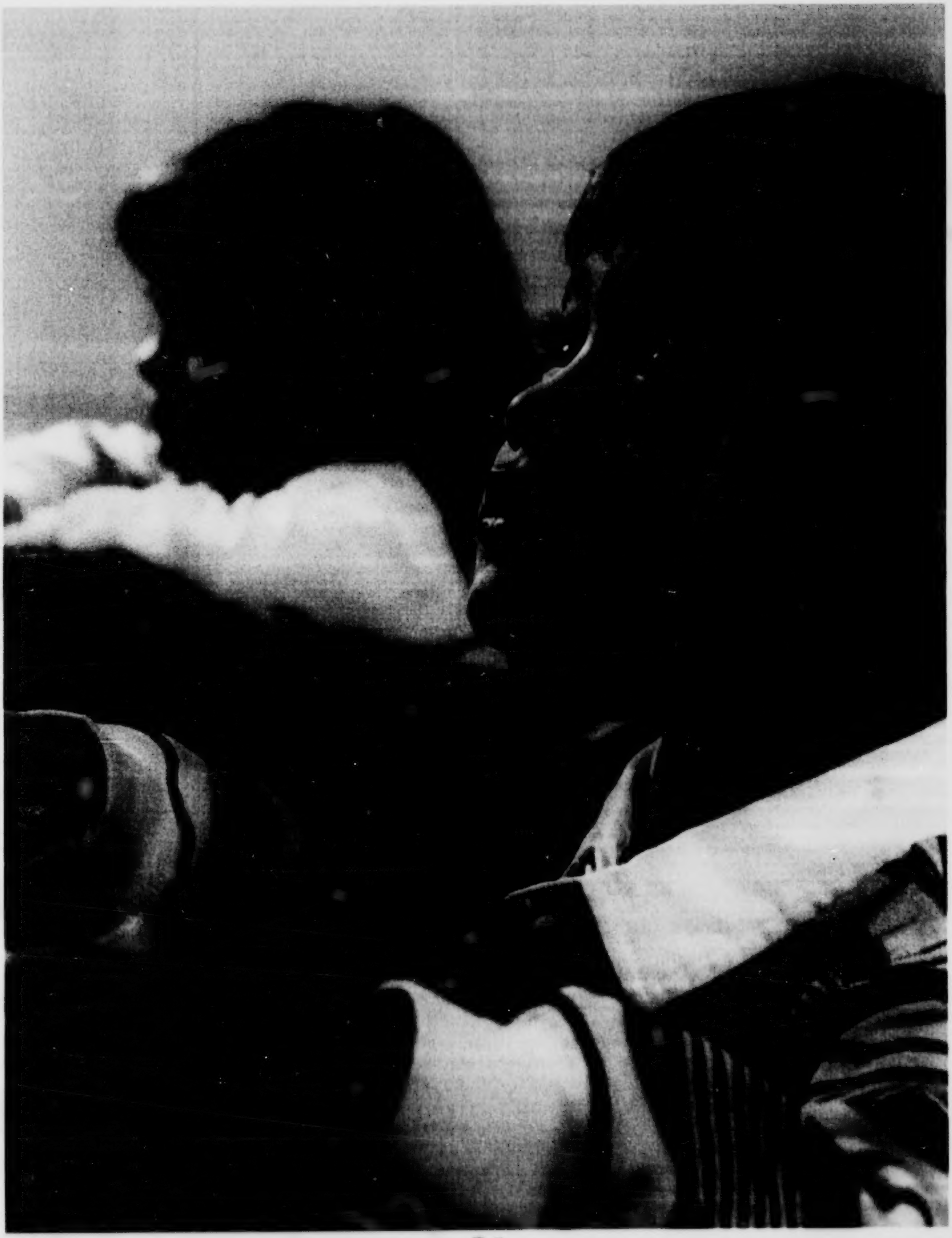


SEIZING THE OPPORTUNITY

Across America, people told us that the Internet offers one of the most promising opportunities in education ever. And yet they were troubled by their inability to harness its potential advantages.

The Web-based Education Commission heard from hundreds of trailblazing heroes around the nation—teachers, principals, and superintendents; local and appointed officials at all levels of government; higher education faculty and administrators; content developers and telecommunications providers; researchers, parents, and students. They testified at live hearings, submitted hundreds of "e-testimonies" on our Web site, and hosted Commissioners at school and university visits, conferences and meetings, live and online.

They shared powerful visions. Their online participation itself was an eloquent demonstration of the power of the Internet.

They urged us to seize the opportunity.

They also showed us a need for changes in policies and priorities that can only become more acute as this technology matures. From their testimony, we have heard a need for:

- **Broadband Access**
- **Professional Development**
- **Research and Development**
- **Quality of Content**
- **Regulations and e-Learning**
- **Privacy and Protection**
- **Funding**

- Powerful new Internet resources, especially broadband access, that is widely and equitably available and affordable for all learners
- Continuous, relevant training and support for educators and administrators at all levels
- New research on how people learn in the Internet age
- High quality online educational content that is widely available and meets the highest standards of educational excellence
- Relief from outdated regulations that impede instructional innovation in favor of approaches that embrace anytime, anywhere, any pace learning
- Safeguards to protect online learners and ensure their privacy, especially that of young children
- Sustained funding—via traditional and new sources—that is adequate to the challenges at hand

Perhaps the clearest message of all was that these concerns are interrelated. Like a cabin built log by log, each notched piece sustains all the others.

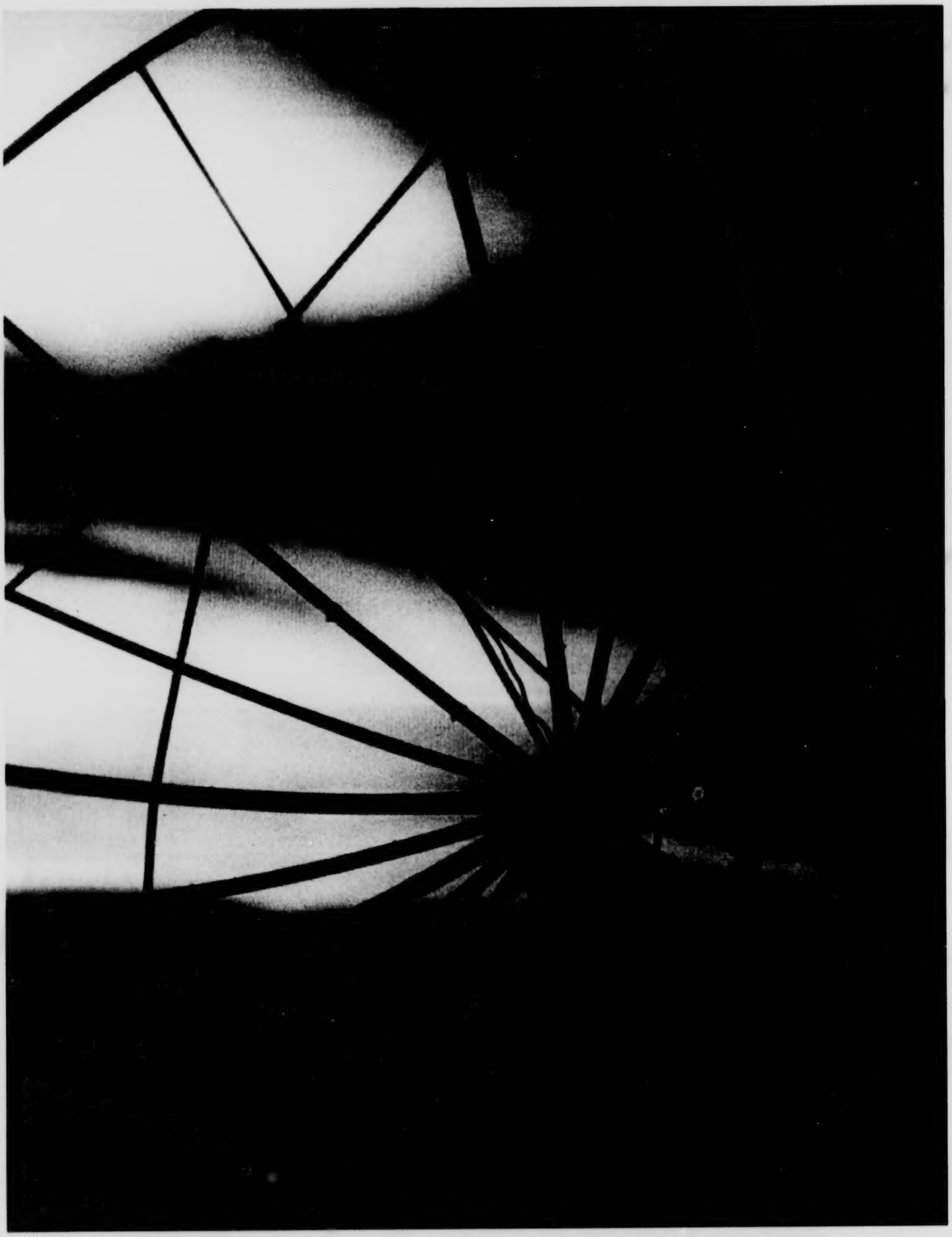
The Commission's recommendations rest on the conviction that solutions come not from the top down, but from all levels of stakeholders in America's educational and economic future.

As such, we are issuing a call to action that is addressed to policymakers and politicians, college presidents and parents, teachers and teacher educators, and students and business leaders. To maximize the power of the Internet for learning we must tackle head on the barriers that are limiting its effectiveness. We must seize the opportunity.

The first barrier is access to technology.

Note to Readers:

A significant number of references are made throughout this report to individual projects and programs, public and private alike. These references should not be regarded as either Commission endorsements or a complete listing of such projects and programs. They are cited for illustrative purposes only.



ACCESS TO BROADBAND TECHNOLOGIES: BRIDGES ACROSS THE DIGITAL DIVIDE

For students to learn with the tools and content of the Internet, they must have ready access to its supporting technology. But even the term access must be more sharply defined. "Access" is more than getting one's hands on a computer, or simply connecting to the Internet.

Access must be convenient and affordable. It must offer a user the opportunity to find and download complex, content-rich resources. The technology that supports access must be where the learner is located and be available whenever he or she needs it. Access may take place in the school or college or adult literacy classroom, in the library or after school center, in the community center or workplace, or in the home.

Those who work with the technology that supports access must have the skill and understanding to apply it well. If the user—whether teacher or learner, parent or administrator—does not know how to work with technology or where to go on the Internet to find material of value, that learner does not have real access to what the Internet offers.

> "....nothing from an educational perspective has more potential to provide a more profound positive change in quality of life than access to web-based education."
>
> (e-testimony, Dr. Edna MacLean, President, Ilisagvik College, Barrow Alaska, Sept. 8, 2000)

Access also implies that once a user has the connection and is able to use it, he or she can find content and applications that have meaning and value for his or her learning needs. Much of the content on the Web is created for adults, not schoolchildren. And little is written at a level that works for the 44 million Americans who read below the average literacy level.[1] Non-English speakers and those from other cultures find little on the "shelves" of the Internet that speaks to them or to their interests.

All these are issues of access—the linchpin connecting all other issues raised in this report.

Without broad access, there will be little demand for the innovative content and applications that can bring new teaching techniques and new assessment models. Without access, teachers cannot benefit from the just-in-time training and support the Internet has made possible in other professions. Without access, schools and universities will not have the links that could move research into practice and practice into research.

Access is fundamental.

WHAT IS BROADBAND AND WHY IS IT SO IMPORTANT?

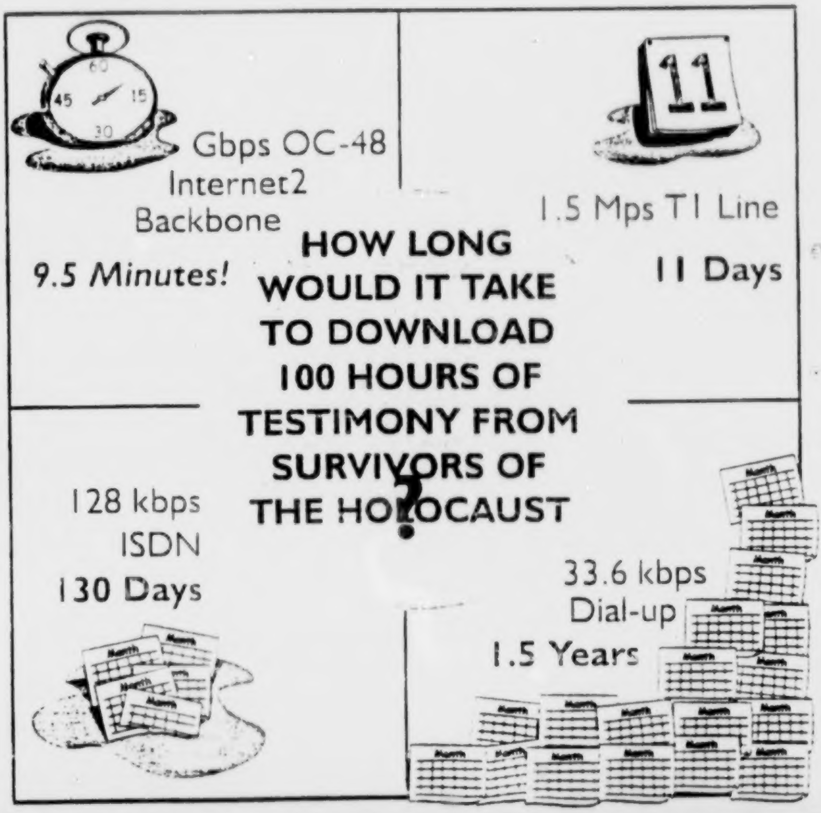
In its purest sense, broadband refers to the transmission of large amounts of data electronically, whether through wire or wirelessly. the more powerful the capability to transmit data, the richer the online experience.

For education, broadband access means the elimination of time and distance from the learning equation. Broadband carries with it powerful multimedia learning opportunities, the full interactivity of instructional content, and the quality and speed of communications. Broadband access today is 50 to several hundred times more powerful than its precursors. Broadband access tomorrow holds even greater promise.

As the table below indicates, the level of broadband capacity determines the degree to which access to rich, engaging online content is possible."

The Visual History Foundation (http://www.vhf.org), through the support of the Shoah Foundation, has collected more than 50,000 unedited testimonies from survivors of the Holocaust. The objective was to create a multimedia archive to be used as an educational and research tool. The archive is comprised of 200,000 plus videotapes filled with more than 100,000 hours of testimony. To watch the entire collection straight through would take about 13 years and six months.

Downloading just the first 100 hours of this testimony at typical school modem speeds of 33.6 kilobits per second would take approximately 1.5 years! High-end broadband capability, if made available in schools, would reduce this download time to a mere 9.5 minutes.



Technology Trends: Delivering on the Promise

The promise of widely available, high quality web-based education is made possible by technological and communications trends that could lead to important educational applications over the next two to three years.

The first trend is toward greater broadband access and better data packet handling capabilities resulting from the new "Internet2" project. For learners this will mean a richer delivery of content than today's delivery of simple text. Tomorrow, higher "bandwidth" will enable richer interactive environments.

The second trend is that of pervasive computing, in which computing, connectivity, and communications technologies connect small, multipurpose devices, linking them by wireless technologies. It is much cheaper to build cellular relay stations than lay miles of cable. Wireless solutions may enable underdeveloped and remote areas to quickly take advantage of the Web via wireless phones, two-way pagers, and handheld devices.

ACCELERATING THE CREATION OF TOMORROW'S INTERNET

Over 30 years ago, large-scale testing, deployment, and development by the academic community leveraged sustained federal investment in fundamental technologies and set the stage for the Internet's commercial success. Applications such as e-mail and the World Wide Web, initially developed to enable collaboration among researchers, have transformed the way we work and learn.

Today, academia, government, and industry are once again working together to sustain the same partnership that nurtured the Internet in its infancy. This partnership is developing, testing, and deploying the high-performance Internet technologies required to enable a new generation of network applications.

"Internet2" and the Next Generation Internet (NGI) initiatives are among the efforts in this area. Internet2 is a consortium led by over 180 U.S. universities working with over 70 leading companies to develop and deploy advanced network applications and technologies for research and higher education. Internet2 members work closely with agencies participating in the NGI. Of major significance for K-12 education, states and districts with existing networks will be able to apply to the NGI to participate in the vast opportunities provided by Internet2 access.

High-performance networking enables applications that can provide qualitative leaps beyond what is possible using today's Internet technology—

- **Digital libraries: HDTV-quality video and CD-quality audio available on-demand will enable students to search interactively, and access and retrieve information previously available at only a few locations.**
- **High-fidelity collaboration: "tele-immersion" and other technologies will allow teachers and students separated by hundreds of miles to interact with each other as if they were sitting across the table.**
- **Virtual laboratories: remote access to scientific instruments will extend to the classroom resources such as mountain-top telescopes and electron microscopes.**

Applications enabled by high performance networking hold the promise to transform education. Just as the Web was unanticipated only a decade ago, tomorrow's Internet may provide us with capabilities and possibilities we have yet to imagine.

For more information about Internet2, see:
http://www.internet2.edu/

For more information about the Next Generation Internet initiative, see: http://www.ngi.gov/

The third trend is digital convergence: merging the capabilities of telephone, radio, television, and other interactive devices. The ubiquitous infrastructure of television will be significantly enhanced by conversion to digital transmission, which has been mandated by the Federal Communications Commission (FCC). Through this increased capability, stations can offer dramatically enhanced programming by "datacasting" a wealth of supplemental information to accompany the regular broadcast. This may include course materials, software, and reference guides delivered via text, video, or audio formats. Direct satellite connections to the home offer another pathway for rich content.[2]

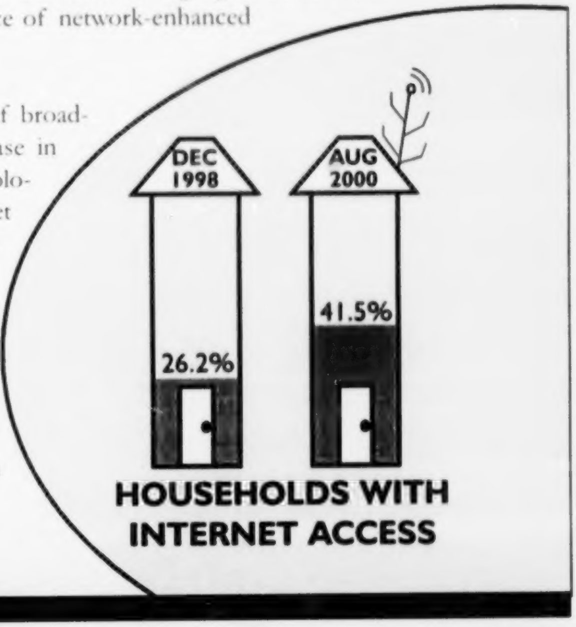
The fourth trend accelerating the pace of educational technology advances is the establishment of technical standards for content development and sharing. Groups involved in developing learning standards are working together under the umbrella of the federal Advanced Distributed Learning (ADL) initiative. Led by the U.S. Department of Defense, with the cooperation of other federal agencies, academia, the private sector, and the technology industry, this group has developed standards for interoperability known as the Sharable Courseware Object Reference Model (SCORM).[3] These standards provide a foundation for the Pentagon to build the learning environment of the future. The influence of this initiative will reach far beyond the military, as have past initiatives including the development of the Internet.

Similarly, the Schools Interoperability Framework (SIF) is an industry initiative to develop an open specification to ensure that K-12 instructional and administrative software applications can work together. Close to 100 hardware and software companies and school districts are involved in this effort.[4] Their objective is to "revolutionize" the management and accessibility of data within schools and school districts, enabling diverse applications to interact and share data efficiently, reliably, and securely, regardless of platform. Adopting standards such as these makes sharing of content and collaborative design more feasible. For example, the SchoolTone Alliance, a global partnership of over 25 leading education service providers, is developing a framework for web-based portals that build on this model.[5]

The fifth trend is the emergence of "adaptive technology"—technology that combines speech recognition, gesture recognition, text-to-speech conversion, language translation, and sensory immersion to change the very substance of network-enhanced human communication.

A final trend is the dramatic drop in the unit cost of broadband. Bandwidth will decrease in cost and increase in power more rapidly than the advances in chip technology described by Moore's law.[6] Ubiquitous Internet access can become a viable option for all, rather than a privileged few.[7]

These are promising trends. But to benefit fully from these trends, learners must have affordable, easy access to the computing power necessary to bring these resources to the desktop, the laptop, or the appropriate Internet-enabled handheld—or even wearable—device.



Digital Inclusion: Are We Doing Enough?

A number of surveys tracking the growth of computer connections in homes and schools provide a picture of what the U.S. Department of Commerce calls a growing trend toward "digital inclusion."[8] But digital inclusion must work wherever the learner and learning opportunities come together—at home, at school, and on the college campus.

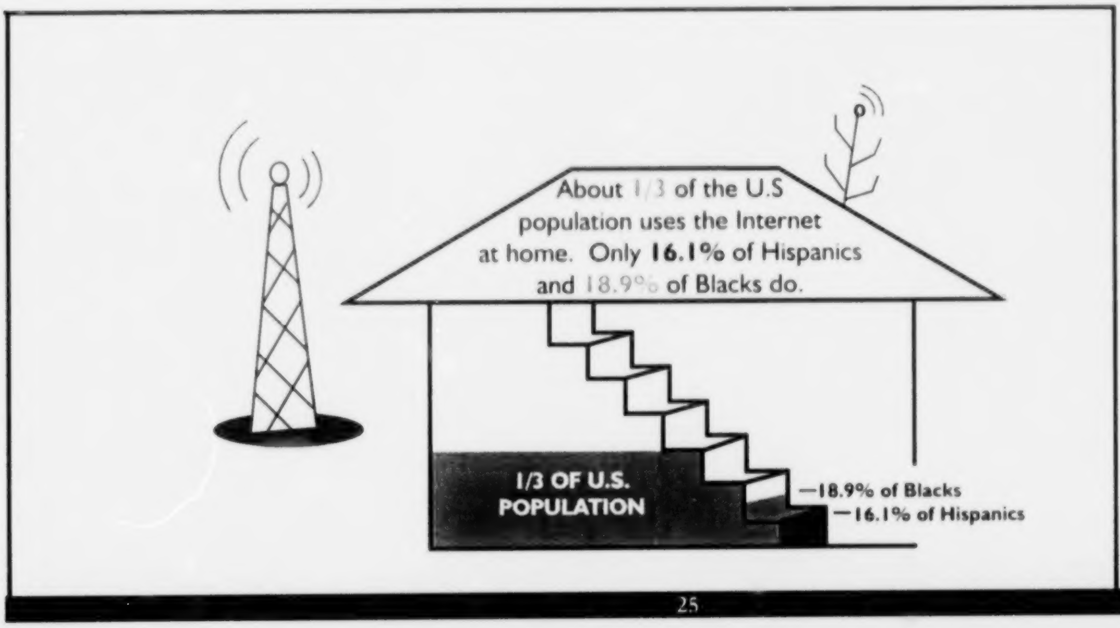
Household Internet Access[9]

In the last two years Internet access in households has grown dramatically. In just a year and a half (from December 1998 to August 2000) the share of households with Internet access doubled, rising from 26.2 percent to 41.5 percent. Rural households are catching up. The data show a 75 percent increase in rural household access over this 18 month period, so that today 38.9 percent of rural households have Internet access. Broadband penetration is still greater in central cities (12.2 percent) and urban areas (11.8 percent) than in rural areas (7.3 percent). The national average for households with broadband access is 10.7 percent.

But troubling gaps remain and are expanding in some cases:

- **Between December 1998 and August 2000 the gap in Internet access between Black households and the national average grew from 15 percent to 18 percent; for Hispanic households the gap grew from 14 percent to 18 percent.**

- **About a third of the U.S. population uses the Internet at home; only 18.9 percent of Blacks and 16.1 percent of Hispanics do so.**


About 1/3 of the U.S population uses the Internet at home. Only 16.1% of Hispanics and 18.9% of Blacks do.
1/3 OF U.S. POPULATION
—18.9% of Blacks
—16.1% of Hispanics

> "The current implementation reminds me of the early development of the interstate highway system in the early 1960s. You could drive for a few miles on a four-lane highway at higher speeds and then drive long distance on an old two-lane highway at lower speeds. The current Internet delivery network allows information to travel in the same uneven way."
>
> (e-testimony, class.com, August 23, 2000)

Home access is important for students doing research, taking online courses, and communicating with teachers and other learners. For parents, online access means new kinds of communication with their children's schools, with their children's teachers, and with other parents. For all households, Internet access is another way to connect with their communities and government services. Home access helps to advance economic opportunities: low-income users were the most likely to report using the Internet to look for jobs.

Wiring Schools and Libraries

Those learners without Internet access at home rely on schools, libraries, and other public places to provide this access. For households with incomes below $40,000, students are more likely to have Internet access at school (31 percent have Internet access at home versus 56 percent at school).[10]

For many economically disadvantaged and minority group youngsters, a computer at school or in the library after school is the only link to the wide world of the Internet.

Educational institutions are struggling to provide students with Internet access, and great strides have been made in bringing schools, libraries, and postsecondary institutions online.[11]

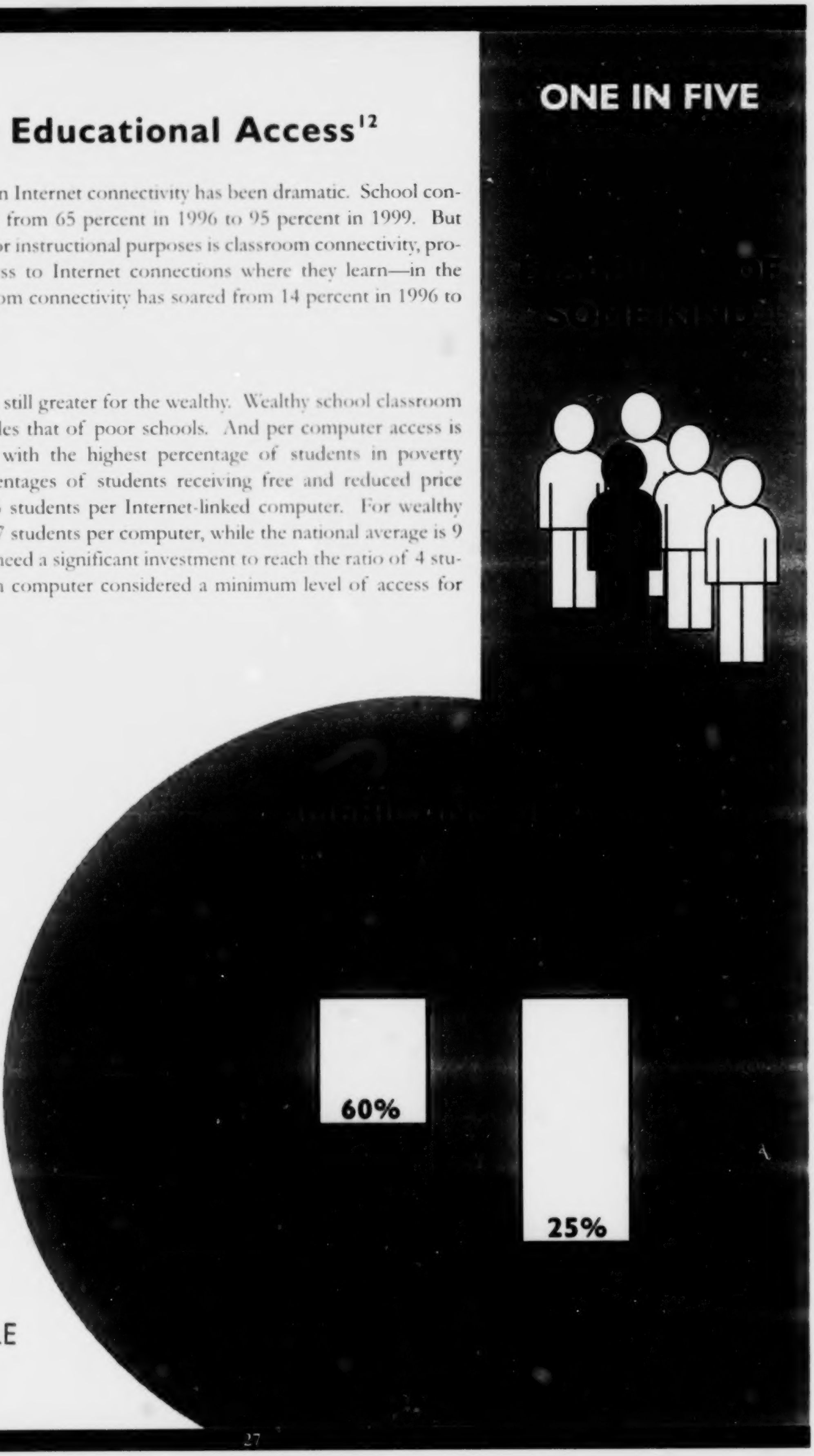
But here again, there are gaps.

The E-rate has been a major factor in providing school and library access. Enacted as a part of the Universal Service Program of the Telecommunications Act of 1996, the E-rate program provides discounts to public and private schools, libraries, and consortia on the costs of telecommunications services, Internet access, and internal networking. However, E-rate discounts do not reach places where many others could benefit from the learning opportunities of the Internet—from daycare centers to senior centers, and from adult literacy programs and community centers to museums, and other venues for both formal and informal learning.

K-12 Educational Access[12]

The recent growth in Internet connectivity has been dramatic. School connectivity has grown from 65 percent in 1996 to 95 percent in 1999. But what counts most for instructional purposes is classroom connectivity, providing student access to Internet connections where they learn—in the classroom. Classroom connectivity has soared from 14 percent in 1996 to 63 percent in 1999.

Classroom access is still greater for the wealthy. Wealthy school classroom access almost doubles that of poor schools. And per computer access is no better: schools with the highest percentage of students in poverty (measured by percentages of students receiving free and reduced price lunches) average 16 students per Internet-linked computer. For wealthy schools the ratio is 7 students per computer, while the national average is 9 to 1. Poor schools need a significant investment to reach the ratio of 4 students per classroom computer considered a minimum level of access for effective use.[13]



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Postsecondary Institutions

Postsecondary education institutions are also rapidly expanding student access to the Internet. Yet, there are institutional disparities. For example, 58 percent of all postsecondary students own their own computer. This figure varies from a high of 79 percent of students at private universities, to 34 percent of those attending private two-year institutions, and 39.6 percent of those attending public two-year institutions.[14]

The lower figure for community colleges is particularly troubling because community colleges—with their tradition of low tuition, flexible programming, open door admissions, and customized services—enroll proportionately larger percentages of the postsecondary student population, and larger percentages of minority students. Currently 55 percent of Hispanic- and Native-Americans, and 46 percent of African-American undergraduates, are enrolled in community colleges.[15]

In e-testimony to the Commission, the United Negro College Fund (UNCF)[16] reported that only 15 percent of students attending member institutions had their own computers. They also reported that:

- **College students nationally are more than twice as likely to have access to a college-owned computer than their private historically-black colleges and universities counterparts (one computer for every 2.6 students in higher education institutions nationally vs. one for every 6 students at UNCF colleges and universities).[17]**
- **Seventy-four percent of faculty nationally owns their own computer[18] as compared with only half of UNCF faculty. Less than half of UNCF faculty have college-owned computers at their desks.**
- **The number of network servers at UNCF colleges per 1,000 students is approximately half that of all colleges and universities nationally.**
- **Seventy-five percent of these servers, hubs, routers, and printers are obsolete or nearly obsolete and need replacement.**
- **Because so many of these institutions are located in rural areas, they face the additional burden of limited access to high-speed Internet access or other learning resources.**

MAKING TECHNOLOGIES MORE ACCESSIBLE FOR THOSE WITH DISABILITIES WILL MAKE THEM MORE ACCESSIBLE IN WAYS THAT BENEFIT ALL USERS:

Internet Ramps for the Disabled

One in five Americans aged 16 and over has a disability of some kind[19]. As our population ages, the number of learners with vision, hearing, and physical limitations will continue to grow.

The Internet is a double-edged sword for these learners—it can be a gateway to new opportunities, or a barrier that challenges them even further. Among Americans of all ages, nearly 60 percent of those with a disability have never used a personal computer, compared with 25 percent of those without a disability. Among those with a disability, people who have impaired vision and problems with manual dexterity have even lower rates of Internet access and are less likely to use a computer regularly than those with hearing and mobility problems.[20]

Students with disabilities comprise 11 percent of preK-12 and 7.2 percent of beginning postsecondary students.[21] Current laws mandate that recipients of federal funds cannot discriminate on the basis of disability. These laws have been extended to ban discrimination by any state or local government under the Americans with Disabilities Act.[22] Educational institutions receiving federal funds must offer equitable access to technology for all students.

With the advent of adaptive technology, equity of access for disabled students is possible. Speech synthesizers and screen access software allow the computer to speak whatever text appears on its monitor, facilitating use for blind users. Audio components and simulcasts can be accompanied by real-time captioning. But not all sites and not all distance-learning programs provide these capabilities.

- **Multiple means of representation (e.g., a math concept) in both text and graphic modes, animated science simulations, poetry read aloud by the author, etc.**
- **Multiple means of expression for the learner (use of text, sound, images, video, and combinations of media as vehicles for expressive literacy through writing, illustrating, speaking, video-making, and drawing).**
- **Multiple means of engagement to attract the easily bored or the easily distracted learner.**

Currently, there are basic design and development guidelines that are widely available and accepted by industry and consumers, through the Web Accessibility Initiative of the World Wide Web Consortium.[23] As a support for Web site developers, the Center for Applied Special Technology (CAST) created Bobby, a Web-based tool that analyzes Web pages for their accessibility to people with disabilities. CAST offers Bobby as a free public service in order to expand opportunities for people with disabilities through the innovative uses of computer technology. Once a Web site receives a Bobby approved rating, it is authorized to display a "Bobby Approved" icon. CAST also maintains a database of Bobby-approved Web sites.[24]

Universal designs are those that eliminate "gratuitous barriers" while adding functional equivalents. These universal design principles ultimately benefit all learners.[25]

They support what neuroscience and other learning research have shown us about learning—there is not one "typical" learner, just as there is not one path to learning. Web-based learning environments can provide support and challenge through multiple means of:

- **Representation (e.g., a math concept in both text and graphic modes; animated science simulations; poetry read aloud by the author; etc.)**

- **Expression (i.e., use of text; sound; images; video; and combinations of media as vehicles for expressive literacy through writing, illustrating, speaking, video-making, and drawing)**

- **Engagement to attract the easily bored or the easily distracted learner**[26]

Designing accessibility into an Internet site or a course at the beginning is far less expensive than after the fact. Designs that create barriers harm everyone, not just people with disabilities.[27]

In the final analysis, if the Internet is to raise the quality of education for some of our nation's learners, it should do so for all.

DIGITIZING DAKOTA!

South Dakota, with its sparse population and large landmass, has 127 school districts with fewer than 600 students. In the past, many of these small schools could only provide a basic curriculum. Governor William Janklow committed to equalizing education through network-based technology. The challenge he issued was immense: connect every classroom in 622 buildings so that three out of four students could simultaneously use the Internet.

The solution? The Governor commissioned 11 teams of inmates from the South Dakota corrections system, and had them trained to install 101,250 commercial grade network connections. The state provided supervisors and materials, the schools provided food and lodging for the inmates. Over three years, the classrooms of every public and private school with more than 50 students were wired with Category V wire, video cable, and additional electrical power. The resulting school area networks were then linked into school district networks. Connections were also installed in libraries, government offices, public universities, and technical institutes.

Sixty-three telecommunications companies serving South Dakota provided connections. The resulting Digital Dakota network[1] became the state Internet Service Provider, which provides services to the K-12 schools, libraries, units of government, postsecondary education institutions and universities. Since the Digital Dakota network is a full fledged data communications network, schools can implement client-server information systems using video, data, and voice components.

How was this financially possible? Without the inmate labor and large-scale purchases of materials, the cost could have been as much as $100 million. Governor Janklow also used state and federal education improvement funding to provide the $15 million needed to connect the K-12 classrooms. Local school boards are providing the computers for the classrooms, with help from businesses. U.S. West donated interactive television equipment, worth $17 million, enough for every high school and middle school to set up one classroom that could generate and receive video.

The Governor understood that without teacher training infrastructure alone would not improve learning. An intensive teacher-training program was created and implemented through the universities and technical institutes in South Dakota. Thirty percent of the K-12 teachers received 200 hours of training during the summer. They each received a $1,000 stipend for attending the training, and another $1,000 to purchase software for use in their classrooms.

In addition, K-12 administrators participated in two-week intensive workshops to prepare them to lead their communities in the use of the innovative network. Teachers and staff from each of the 176 school districts were trained to operate the servers connecting their local schools.

Seventeen percent of the university faculty received three months of summer support to incorporate technology into their instructional programs.

The state has developed an extensive framework of content standards to direct the learning expected by each student. The Rapid City School District is working with the South Dakota School of Mines and Technology to develop software to link students, teachers, and parents into a partnership for enhanced individual learning. This innovative partnership will combine the best features of traditional teacher-delivered education with broadband technologies.

South Dakota offers a world-class example of how to democratize access to Internet learning.

[1] http://www.support.k12.sd.us/

BREACHING CANYON WALLS: BRINGING THE [illegible] ISOLATED RESERVATION

Just as the Internet was opening up the world, the members of the Havasupai Indian reservation in Arizona felt the walls closing in on them.

Living at the basin of the Grand Canyon, the Supai are isolated on all sides by high canyon walls that make even radio communications impossible. Cable, fiber, and ISDN Internet access, common in densely populated areas, are prohibitive luxuries for this remote reservation.

In short, the "Information Age" gives the Supai reason to feel even more isolated. No group among them has suffered more from this isolation than the Supai children. It was bad enough that these children were left out of the revolution in web-based education. Even worse, they faced a cut-off in critical Head Start services, triggered by changes in the federal program. Head Start now requires teachers in every state to obtain an associate degree in early childhood development or a related field by 2003 and certification by 2005, or face disqualification from the program.

While meeting these requirements is a challenge for many Head Start programs, they absolutely threaten to wall-off geographically remote Indian reservations such as the Supai's.

Fortunately, the Supai decided to take destiny into their hands. They used satellite technology to vault the canyon walls, to open their isolated community, and save their Head Start program.

They did this by turning to Northern Arizona University,[1] an institution experienced in using the Internet and video-conferencing to broadcast higher education classes to isolated communities. Using a federal grant to install satellite dishes, the Supai contracted with StarBand Communications for six satellite dishes: one in the Head Start office; another at the Indian Child Welfare Act office; two at the school; one at the tribal court; and another at the tourist lodge. Now the Supai are working with the university to have an early childhood education program beamed into the community.

A similar story is unfolding in New Mexico, where only 13 percent of Head Start teachers have their associates degree. In this state, the Southwestern Indian Polytechnic Institute (SIPI)[2] has stepped forward to help train Native American Head Start teachers online.

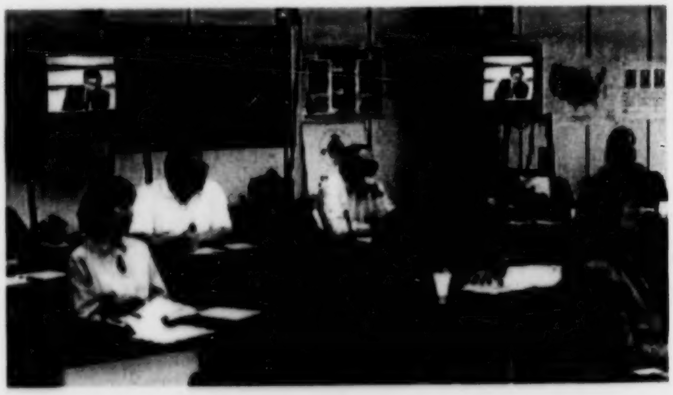
SIPI began with a response to requests from tribal leaders, developing a 70-hour associates degree program in early childhood education that can be delivered by satellite to remote tribal sites in New Mexico.

Early in 2000, SIPI began satellite broadcasts of a two-credit introductory course in child development to the Head Start staff located at the Santa Clara Pueblo. By April 2000, three other downlink sites came online—Mescalero Apache, Southern Ute, and Canoncito Chapter of Navajo. Santo Domingo Pueblo and Jicarilla Apache have installed their own downlinks and are now served by programming from SIPI.

By December 2000, additional sites will be operational with SIPI downlinks at Laguna Pueblo, Ramah Navajo, Alamo Navajo, and Jemez Pueblo. More advanced courses required for national Head Start certification are also being broadcast to sites at the request of tribal leaders.

The early childhood education degree program, which will be transferable to four-year institutions in the state, will begin January 2001 with an enrollment of 60 student-employees of a tribal Head Start Program.

Harlan McKostao, producer of the national call-in radio program "Native America Calling," sees in these efforts the beginning of a greater opportunity for the reservation to link to the wider world. Connecting tribal schools, colleges, and community centers, McKostao says, is critical because "if you get the school online, you get the whole community."



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[1] See http://www.nau.edu.

[2] See http://kafka.sipi.tec.nm.us.

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3. Among the organizations involved are the Instructional Management System (IMS), the Aviation Industry Computer Based Training Commission (AICC); Institute of Electrical and Electronics Engineers, Inc. (IEEE). For more information see http://www.learnativity.com/standards.html

4. For more information, see http://www.sifinfo.org

5. For more information, see http://www.schooltone.com

6. Moore's law states that the speed and performance of computer chips doubles every 18 to 24 months, thereby expanding computational power in exponential leaps.

7. The price of technologies continues to drop, as evidenced by a nearly 20 percent decline in the 1999 Producer Price Index for electronic computers, which followed decreases of no less than 20 percent in each year since 1997. United States. Department of Labor, Bureau of Labor Statistics. 2000. "Computer Prices Dip Again". *Monthly Labor Review.* MLR: The Editor's Desk, October 2, 2000. http://stats.bls.gov/opub/ted/2000/Oct/wk1/art01.htm

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17. Ibid.

18. Green, op. cit., endnote 14.

19. Based on response to the Survey on Income and Program Participation of the U.S. Census Bureau, research data file August to November 1999, Wave 11. These were defined as difficulty with walking, vision, hearing, using hands, or a learning disability.

20. United States. Department of Commerce, op. cit., endnote 8.

21. Association of Tech Act Projects. e-Testimony to the Web-based Education Commission. August 18, 2000. http://www.webcommission.org/directory

22. Specifically, Title II of the Americans with Disabilities Act provides that "no individual with a disability shall be excluded from participation in or shall be denied the benefits of the services, programs or activities of a public entity or be subject to discrimination by such an entity on the basis of disability." Because Title II covers public elementary and secondary schools and colleges, these institutions must provide the accommodations necessary for deaf and visually impaired students to be able to use the technological resources available to other students in the schools. United States. Department of Justice, Civil Rights Division. e-Testimony to the Web-based Education Commission. August 18, 2000. http://www.webcommission.org/directory

23. For more information, see http://www.w3.org/wai

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24. Bobby Logo is a tradmark of CAST, copyright 1996-2000. For more information, see http://www.cast.org/bobby

25. For more information, see *Making Educational Software Accessible.*
http://main.wgbh.org/wgbh/pages/ncam/cdrom/guideline/introduction.html

26. Association of Tech Act Projects, op. cit. endnote 21. See also Rose, D. and Meyer, A. *The Future is in the Margins: The Role of Technology and Disability in Educational Reform.* White paper prepared for the United States, Department of Education, Office of Educational Technology. Forum on Technology in Education: Envisioning the Future. Washington, D.C. 2000. http://www.air.org/forum/Abrose_meyer.htm

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PROFESSIONAL DEVELOPMENT: HOW TECHNOLOGY CAN ENHANCE TEACHING

Training helps teachers transform lifeless equipment into useful tools. Creating high tech educational tools without training teachers to use them would be as useless as creating a new generation of planes, without training pilots to fly them.

We must train the nation's teachers—and the principals and administrators who lead them—or investments in high tech educational resources will be wasted.

Teachers are the key to effective use of web-based tools and applications, but first they must become skilled at using them.

It is the teacher, after all, who guides instruction and shapes the instructional context in which the Internet and other technologies are used. It is a teacher's skill at this, more than any other factor, that determines the degree to which students learn from their Internet experiences. Teachers must be comfortable with technology, able to apply it appropriately, and conversant with new technological tools, resources, and approaches. If all the pieces are put into place, teachers should find that they are empowered to advance their own professional skills through these tools as well.

This is how it should be. Yet we are far from this ideal today.

- **Almost two-thirds of all teachers feel they are not at all prepared or only somewhat prepared to use technology in their teaching.**[1]

For some teachers, especially those who are older and were educated "B.C."—before computers—technology seems a foreign element, far from necessary to them in their teaching. They grew up without computers, were educated without them, and have taught their entire careers without them.

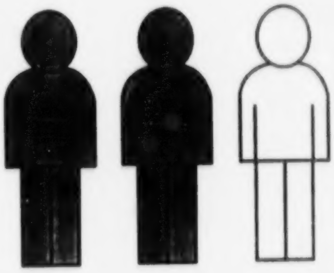
- **Almost two-thirds of teachers (65 percent) had never used a computer before being introduced to one in the classroom. These teachers need basic technology training, especially those who are receiving computers and using the Internet in their classrooms for the first time.**[2]

Getting Beyond the Basics

Basic technology training alone is not sufficient. A recent survey by the National Education Association (NEA) found that most teachers have some facility using computers. Ninety-four percent of NEA members, and 99 percent of those under 35, are able to surf the Web.[3] However, familiarity does not equal proficiency. Most do not know how to apply these skills in classroom instruction.

Common sense holds that technology training for teachers will no longer be an issue if we can wait long enough for a new generation of younger teachers, raised on technology, to enter the profession. However, this is one common sense belief that simply does not hold up to close examination.

Almost two-thirds of all teachers feel they are not at all prepared or only somewhat well prepared to use technology in their teaching.



Another recent survey[4] found that young teachers' self-assessment of their ability to teach with technology was no different than that of their older colleagues. While younger teachers may have basic technology skills—(e.g., the ability to use word-processing software, spreadsheets, presentation software, and Internet browsers)—they realize that they, like their older colleagues, do not know how to apply these skills to teaching.

The ability to use technology for non-instructional purposes does not necessarily translate into either the will or the capability to use technology to support student learning. Although they are not technophobes, these new teachers lack a clear conception of effective classroom uses of technology in their subject area.[5]

Professional development is the critical ingredient for effective use of technology in the classroom. Seventy percent of educators polled regarding technology in instruction put professional development at the top of their list of technology challenges.[6] They said what is needed is both the initial training for those just beginning to use technology and continuing education to support the growth of innovators. Three consecutive years of surveys in higher education showed the same thing: institutions ranked their greatest technological challenge as "assisting faculty to integrate information technology into instruction."[7]

Professional development is often called "training," but the term implies much more than just building basic technology skills. It means developing a vision built on the understanding that technology is a tool that can offer solutions to longstanding teaching and learning problems. It is more than knowing how to automate past practices. It is the growing understanding that comes with confidence to "think with technology" in order to approach old problems in new ways.

Change is necessary on two fronts: in the preparatory (pre-service) education of teacher candidates, and in the continuing (in-service) education of those already in the education profession. Both groups need assistance and support in using the best tools technology offers to meet teaching goals and challenges.

Professional Development and Technology: Too Little, Too Basic, Too Generic

Some might wonder why past investments in technology training for K-12 classroom teachers have not had a greater impact. The reality is that the money spent on teacher training with technology is just a fraction of what is needed. In 1995, the Office of Technology Assessment sounded the alarm in a report on teachers and technology, urging that schools and districts devote at least 30 percent of technology budgets to teacher training and support.[8] Yet, of the $4.2 billion that K-12 schools spent on technology in 1996, only 6 percent was for training.[9] This figure is beginning to rise: in the 1999-2000 school year, 17 percent of public school technology spending went to teacher training, according to an annual survey conducted by Market Data Retrieval. Still, this remains far below the mark. Today NEA recommends that schools devote 40 percent of their technology budgets to teacher training.[10]

The training teachers do receive is usually too little, too basic, and too generic to help them develop real facility in teaching with technology. Ninety-six percent reported that the most common training they received was on basic computer skills.[11] Another national survey of public school teachers found that while most (78 percent) received some technology-related professional development in the 1998-99 school year, the training was basic and brief, lasting only 1 to 5 hours for 39 percent of teachers, and just 6 to 10 hours for another 19 percent of those trained.[12]

Teachers need more than a quick course in basic computer operations. They need guidance in using the best tools in the best ways to support the best kinds of instruction. And they need something more. They need time.

When asked in a National Center for Education Statistics (NCES) survey to name the greatest barrier to their use of computers and the Internet in the classroom, most teachers (82 percent) cited lack of "release time" (time outside classroom) to "learn, practice, or plan ways to use computers or the Internet." This factor outweighed their concern about too few computers (78 percent) or lack of time in the schedule for students to use computers in class (80 percent).[13]

BASIC & BRIEF

Another national survey of public school teachers found that while most (78 percent) received some technology-related professional development in the 1998-99 school year, their training was basic and brief, lasting only 1 to 5 hours for 39 percent of teachers, and just 6 to 10 hours for another 19 percent of those trained.

Comparisons With the Private Sector

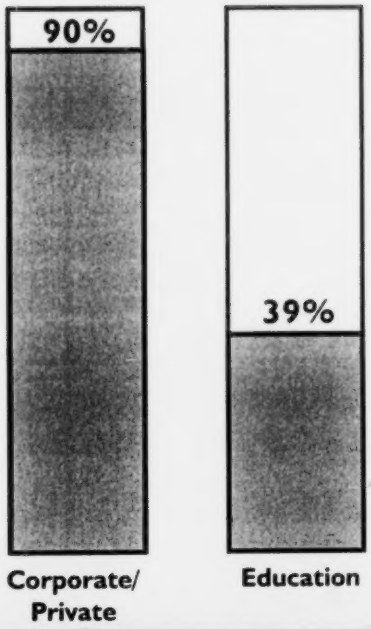
Business, for all its pressure to manage the cost of employee time, doesn't operate this way. Once again, the success of the private sector in integrating technology into its operations suggests a better approach for American education.

In the business world, training is tailored, focused, and just-in-time. In the education world, it is more often one-size-fits-all, generic, and just-in-case.

The overwhelming majority (90 percent) of all corporate and government training occurs on paid time.[14] In public schools, teachers report just over a third (39 percent) of their professional development occurs on paid time.[15] Professionals in other fields expect to be trained regularly. Motorola, long the standard for industry, provides every employee with at least 40 hours of training each year.[16]

Equally significant, professionals in other fields are provided with follow-up support needed for that training to take root—including immediate access to the hardware and software on which they are trained, Internet connections, and easy access to support personnel and follow-up skill building.

TRAINING CONDUCTED ON PAID TIME



Many teachers have been trained on systems not installed in their schools. Many do not receive follow-up support. Only 67 percent of teachers in the NCES survey reported that follow-up or advanced training was available to them.

Most business professionals have personal computers provided to them at work and some industries give employees computers they can use at home (such as Ford Motor Company). But K-12 teachers rarely are provided these benefits. Although 62 percent of teachers have access to a desktop computer while at school, only 28 percent have the ability to borrow one for occasional use at home.[17]

Most teachers are not rewarded or reimbursed for the time they spend in training. Just as some teachers spend their own money for classroom supplies, some teachers pay for their own preparation. Many take classes on their own time and pay their own tuition or fees. For example, OnlineLearning.net, an online continuing education provider, offered over 1,000 courses in the past year. Over 6,000 teachers enrolled in these courses. Eighty-five percent paid the $450 tuition fee on their own.[18]

Technology training rarely translates directly into higher pay for teachers. In fact, a growing concern among schools is the lure of higher salaries offered in the private sector to teachers and administrators who do exhibit strong technical proficiencies or a desire to develop these.

In sum, the message to teachers is a mixed one—we expect you to teach with technology, but we will not help you do so.

There are other ways K-12 teachers are treated differently than professionals in business and industry. Intellectual support, as well as technical support, is rare. A recent national study found that only 13 percent of the nation's teachers work in what could be defined as a "high quality technology-supported environment."[19] For most teachers, technical assistance is limited, if available at all.

Another study measuring technology support for district technology coordinators in 27 states found that it took from 14 hours to more than 7 days to fix a technology problem in a school or classroom. The average response time was more than two days.[20] While this would be unthinkable in most businesses, imagine what it means to a teacher who has developed a lesson around the Internet, only to discover that the whole class is disrupted for an unknown period of time. It is simply intolerable.

Fewer than 20 percent of all schools have a full-time technology coordinator. In most cases, technology coordinators are charged with training teachers and helping them integrate technology in their classes. In reality, they spend most of their time on technical support. On a weekly basis, full-time technology coordinators spend only 3 to 4 minutes per teacher assisting with technology integration. Part-time technology coordinators perform this kind of assistance only 1 to 2 minutes per week.[21]

Bringing Teachers Out of Isolation

But the larger problem is one that is endemic to the K-12 teaching profession—the isolation of the classroom teacher. How can Internet access change that?

Most of a teacher's day is spent separated from colleagues, with little time or opportunity to share in the give-and-take of problem-solving common in most office or work environments. For elementary and secondary education teachers, planning periods are few and often occur in isolation. Group meetings are focused on issues that affect the institution as a whole or the department or grade level, but they don't offer the opportunity to express the concerns or share the wisdom of the individual teacher.

Teachers rarely have the opportunity to work with others to share their questions, concerns, and successes. Most are isolated and, unlike other professionals, have little access to the resources they need to stay up to date in their fields. In contrast, teachers in other countries are provided far more paid time for planning: Japanese teachers spend about 40 percent of their paid time on professional development and collaboration compared with about 14 percent for their American counterparts.[22]

The Internet as a Tool for Teacher Learning

tappedin

www.tappedin.org

Fortunately, the Internet is making it possible to connect teachers to each other, giving opportunities for mentoring, collaboration, and formal and informal online learning. Traditional one-size-fits-all professional development workshops are giving way to a new, more teacher-centered, self-directed model of teacher learning. Through the Internet, teachers have access to high quality online professional development opportunities beyond what the local school or district is able to offer.

Online courses and seminars, follow-up consultations and mentoring, and collaborations with experts and peers can take place without the expense and classroom disruption created by repeated absences for face-to-face meetings. And, in working in online environments, teachers obtain a collateral benefit: they learn important technological skills.

A supportive social structure is one of the key elements for successful online learning. In projects like SRI International's TAPPED IN program, supported by the National Science Foundation, the technological tools and communication resources serve as the underpinnings of a well-maintained community of practitioners.[23] Those wishing to create their own projects are assisted by TAPPED IN support personnel. User groups include school districts, museums, and teacher education programs. Through TAPPED IN, educators can participate in online courses, take their own students online, experiment with new ways to teach or conduct research, or participate in community-wide events. Since opening in 1997, TAPPED IN has served more than 9,000 K-12 teachers, librarians, researchers, teacher education faculty, professional development staff, and other education professionals.

Wanted: Two Million New Teachers

But unless new teachers enter the classroom ready to teach with technology, we will never catch up. If teacher education programs do not address this issue head on, we will lose the opportunity to get it right with a whole generation of new teachers—and the students they teach.

The size of the challenge is staggering.

There are three million teachers in K-12 schools today. In the next decade alone, we must recruit and train two million more new teachers just to replace retirees and to meet expected growth in enrollment.

Put another way, one-third of today's teachers have 20 years or more of teaching experience; two-thirds are in mid-career. As the teacher population ages, moving into retirement, 54.2 million students are expected in K-12 education by 2009, up 2 million from 1997.[24] We need a fundamental change in recruiting new teachers, and giving them the tools to do a more effective job.

In the midst of this crisis, teacher education has yet to come to grips with the immediacy of preparing a new generation of teachers to use technology as a teaching tool.

Teacher education programs tend to be profit centers for colleges and universities—they pay for themselves with strong and steady student enrollments and have few of the expenses associated with equipping science laboratories, engineering, or other professional programs.

We should expect a college of education to provide, at a minimum, a high tech teaching laboratory that models instructional use of technology for the entire campus. We should expect college and university presidents and trustees to make the necessary adjustments. Yet this is rarely the case.

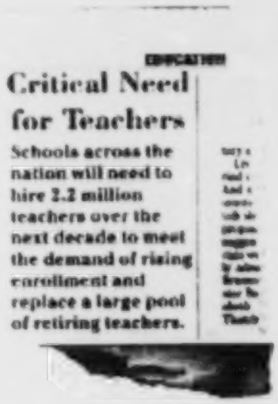
As noted in a 1999 report on teacher preparation by the CEO Forum on Education and Technology, many teacher education programs "receive less attention than the higher status professional programs in the university such as law, engineering, business, and medicine… (Furthermore, they) have a less affluent alumni base, meaning that large gifts from donors (as well as industry) are harder to obtain."

The most recent Campus Computing Project survey asked chief technology officers (CTOs) of higher education institutions to compare the information technology components in departmental programs across their campuses. Overall, the CTOs ranked their campus' education programs eighth of 10 in use of the Internet and Web resources, seventh in the use of technology for instruction, and tied for sixth in preparing their students with the technology skills needed over the next decade.

Most teacher education institutions now offer what is called "the course" in information technology. But providing a stand-alone course about technology is not the same as ensuring that courses in teaching methods integrate technology as a way of building understanding or assessing learning.

Faculty in teacher education programs, many of whom were educated and taught in schools before computers were a part of the educational landscape, are not comfortable or skilled in teaching with technology. This problem extends across the college experience of teacher candidates. If they do not see their faculty use technology in the courses they take outside their teaching major (whether in science, literature, math, and history departments), tomorrow's teachers will not have a full understanding of how technology advances understanding in each academic area.

It is clear that the need for professional development in technology among higher education faculty parallels that required by educators in K-12 schools. It is also clear that our campus higher education leaders have a deep responsibility for modernizing their colleges of education and incorporating a priority on teaching and learning with technology.



EDUCATION

Critical Need for Teachers

Schools across the nation will need to hire 2.2 million teachers over the next decade to meet the demand of rising enrollment and replace a large pool of retiring teachers.

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Making Professional Development in Technology a High Priority

There are, of course, exceptions and promising new practices that suggest change is coming. These include leadership initiatives undertaken by Congress, the states, universities, professional organizations, and the business community.

- **The Higher Education Act Amendments, passed by Congress and signed into law in 1998, provide a gateway for technology integration in college teacher education programs.** A major objective within the section of the Act focusing on enhancing the quality of teaching in the U.S. is to "hold institutions of higher education accountable for preparing teachers who have the necessary teaching skills and are highly competent in the academic content areas in which the teachers plan to teach, such as mathematics, science, English, foreign languages, history, economics, art, civics, Government, and geography, *including training in the effective uses of technology in the classroom…*" (emphasis added)[29]

- **An increasing number of states (42) now require teachers to demonstrate proficiency in technology as one component for receiving certification.** However, only 4 require technology training for re-certification.[30]

- **The National Council for Accreditation of Teacher Education (NCATE),[31] the largest accreditation association of schools, colleges, and departments of education, has made technology an area of accreditation focus.** While this is an important leadership message, only 38 percent of the nation's 1,300 teacher preparation programs are accredited by NCATE. Many schools, colleges, and departments of education choose not to apply to NCATE; others have been unable to meet its standards.

- **The CEO Forum developed a special STaR (School Technology and Readiness) self-assessment tool for schools and colleges of education.[32]** At the urging of Education Secretary Richard Riley and President Bill Clinton in May 2000, 243 institutions have "taken the pledge" to conduct self-assessments as a first step for turning their programs around and moving from "early tech" or "developing tech" to "advanced tech" or "target tech."[33]

New funding initiatives have also led to promising practices. The National Science Foundation-supported "Inquiry Learning Forum"[34] is a model of using the Internet for teacher growth. The U.S. Department of Education's Preparing Tomorrow's Teachers with Technology (PT3) Program, begun in 1999, is bringing new ideas, new collaborations, and new models to teacher education. The PT3 program has made $150 million in federal funding available to 352 teacher preparation institutions to help them develop capacity, implement new programs, and provide innovative catalysts for broader change. These programs are just beginning to take root, but they offer promise for the future.[35]

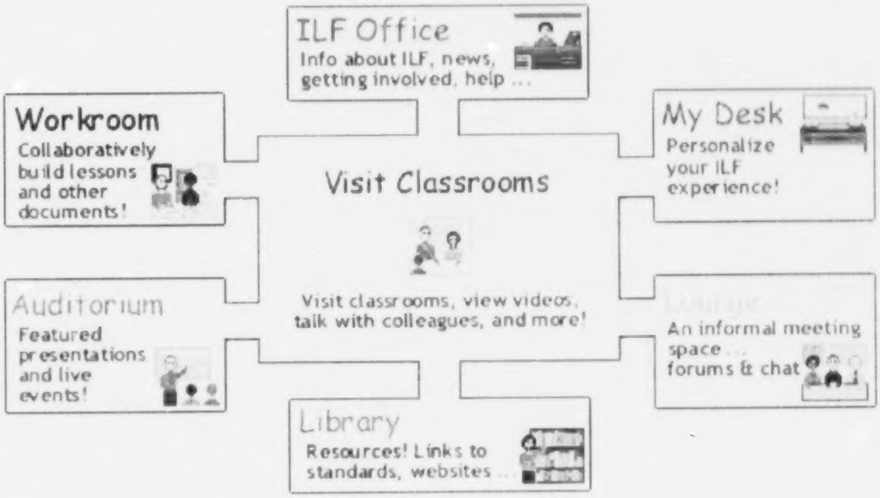
HELPING ISOLATED TEACHERS MAKE NEW CONNECTIONS

Many teachers lack connections to colleagues with similar interests, responsibilities, and challenges. Imagine being the only physics teacher in a school. Under normal school conditions, you could go for weeks or months without contact with another physics teacher. Sharing teaching strategies and content with colleagues or even getting outside advice or constructive criticism—this just isn't a part of your world.

No wonder so many teachers feel professionally isolated.

Four hundred teachers in Indiana are turning to a new online environment, the Inquiry Learning Forum (ILF)[1], to establish connections with other teachers, as well as to expand access to classroom resources. They are acting to end the isolation of teachers.

The ILF is a video centered, web-based learning forum designed to support an online community of current and future science and mathematics teachers interested in "inquiry-based" teaching. The ILF provides opportunities to virtually "visit" classrooms across Indiana. It features a large video library of classroom episodes and enables teachers to discuss, annotate, reflect upon, and replay these classroom episodes as needed.


ILF Office
Info about ILF, news, getting involved, help ...
Workroom
Collaboratively build lessons and other documents!
My Desk
Personalize your ILF experience!
Visit Classrooms
Visit classrooms, view videos, talk with colleagues, and more!
Auditorium
Featured presentations and live events!
Lounge
An informal meeting space ... forums & chat
Library
Resources! Links to standards, websites ...

The home screen of the ILF, shown here, displays which of the classrooms are available through the Visit Classrooms space. When ILF members select a specific classroom lesson, they can view a videotape of that lesson being implemented. They can also review a lesson overview, reflective commentary, descriptions of teaching activity, lesson plans, students' examples, and connections with both state and national standards.

In addition to the Visit Classroom spaces, there are also 5 other virtual spaces designed to support professional development needs. The ILF Office is the place where new partici-

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pants can secure a password, get help with technology, or make suggestions. The Workroom provides groups with an online space to form working circles, or sub-communities, that facilitate collaboration on a particular project, product, or goal. The Lounge hosts general conferences that are not tied to a particular classroom as well as a space for real-time chat to allow users to communicate with others. The Auditorium is the place where special events can occur. These usually involve chat discussions with a white board and resources. It also provides the opportunity for video-casting live or recorded presentations for discussion. Any member of the community can hold a workshop, experts can be brought in, or there may be simultaneous discussion of specific issues.

The Library is a place where teachers can go to access reference materials of interest, including references on teaching resource materials (software, other classroom artifacts like the graphing calculator, manipulatives, sensory probes), state and national standards, grants, applied research and theory, state initiatives, and other materials the teachers identify as relevant.

Finally, My Desk is the place where a teacher can store bookmarks to resources and classrooms of personal interest. Not only do teachers have the opportunity to share lesson plans, unit plans, and other resources through the ILF, they are also able to watch other teachers implement these resources in their classrooms, read the personal reflections of these teachers, and discuss what they have seen, heard, or read. Every classroom resource available in the ILF community is "attached" to a videotaped segment of a lesson or a particular discussion thread. This enables teachers to not only find resources, but also to read or hear about how they might be used in a particular classroom.

Dr. Sasha Barab, the project principal investigator, expects the ILF to grow by more than 1,000 members by 2002. Plans are underway to extend the ILF beyond Indiana, providing a welcoming space that can help make teachers feel less isolated and more a part of a professional community.

1. http://ilf.crlt.indiana.edu/

CO-AUTHORS IN CYBERSPACE

"I want my students to have a rich experience with words," says Florence McGinn, a poet and an English teacher at New Jersey's Hunterdon Central Regional High School (HCRHS). "I want them to have a sense of audience."

Through the award-winning, student-created online magazine ELECTRIC SOUP, McGinn uses technology to open up opportunities for individualizing learning and challenging her students to take on fresh, empowering roles. Technology is a central tool for the students' creative writing and communications. This online magazine is both showcase for the students' talents and learning space for their creativity. It includes:

- **Poetry, short stories, and essays supported by rich backgrounds, digital images, and animated graphics**
- **A special feature for Hunterdon alumni to demonstrate how the writing process continues after graduation**
- **A Community of Writers segment featuring the works of teachers, community members, and outside contributors**
- **A Young Writers' feature for elementary and middle school student writers as well as for those who write for younger readers**
- **Silicon Sound, which offers RealAudio of original student poetry, produced as song**
- **A Virtual Gallery that highlights student-created 3D images and digital animations**
- **An international feature with work from writers of all ages from around the world**
- **An interview section featuring writers, educators, and business leaders**

Classroom computer stations equipped with small cameras, audio, electronic notebook software, and annotation tools provide HCRHS student writers with live communications links with university student mentors at Rider University. The high school students meet weekly with these university mentors to discuss manuscripts in a lively, re-imagined, electronic version of the traditional writing workshop. Feedback is immediate and focused. The university student mentors, who receive English credit for the supervised interaction, grow with the high school writers.

McGinn's class also uses technology to link students to distant schools with very different cultures. The English class is linked to a class in

Asbury Park High School, an urban school in another part of the state. The students work together in cyberspace to write and publish collaboratively.

Hunterdon student Emily Judson writes of her experience as a writing mentor with the Asbury Park students:

"During our videoconferencing sessions, the Asbury Park students have the choice of either showing me a manuscript or writing a collaborative poem. If they choose to show me a manuscript, I provide them with feedback on areas of strength as well as suggestions to improve stylistics, imagery, and symbolism. If we choose to write a collaborative poem, one person begins by writing the first line, then the person on the other side will write the next line; this method is utilized throughout the entire poem. Since we come from two different cultural backgrounds, the collaborative poems are especially intriguing because our writing styles are very different. Yet, in this type of poem, our styles fuse, creating a metaphorically evocative piece of writing . . ."

Another Hunterdon student, Evan Machusak says his experience with Asbury Park students, "opened my eyes to a kind of courage I have never seen before. It's the courage to try in spite of the odds, the courage to reach for something more than what you see around you or what people expect of you."

Students like Evan and Emily assisted writers at Asbury Park in publishing their own literary magazine, SONGS OF HOPE.[2]

McGinn says her role is to introduce students to the software's potential and its vocabulary, to guide them toward challenging learning goals, and to help them achieve and innovate. "Once involved, students become active and empowered. They shift naturally from roles of learner to those of mentors, teachers, and leaders."

The teacher remains the ultimate mentor, the person who both challenges and nurtures. Student Neela Mookerjee says, "I wouldn't bother attempting a second multimedia presentation if no one had cared when I made the first one. I wouldn't pursue a new avenue of exploration or undertake a challenge if no one was enthusiastic when I talked about it."

McGinn, who was not trained in technology, learned about the emerging technologies with her students. She encourages educators to "simply start where you are to empower your students. Enable their exploration, mentor their learning, and they will empower themselves to share the rich bread of technology and its modern opportunities."

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[1] See http://www.hcrhs.hunterdon.k12.nj.us/esoup/welcome.html

[2] See ELECTRIC SOUP's Asbury Park feature: http://homer.hcrhs.k12.nj.us/esoup/esvol10/index.html

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34. This initiative is descibed in the Illustrated Story *"Helping Isolated Teachers Make New Connections"* in this report. For more information, see http://ilf.crlt.indiana.edu

35. For more information, see http://pt3.org

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CORRECTING A PAUCITY OF RESEARCH AND DEVELOPMENT

We must establish a pedagogical base for the effective use of Internet learning. We need a vastly expanded, revitalized, and reconfigured educational research, development, and innovation program, one built on a deeper understanding of how people learn, and how new tools support and assess learning gains.

"I would be astonished if a sustained educational research program like the one envisioned by the PCAST panel (at a level of $1.5 billion per year) failed to yield at least a 5 percent improvement in what economists refer to as the 'education production function'—the ratio of educational outcomes (measured using some reasonable metric) to educational expenditures."

(David E. Shaw, Chairman and CEO, D. E. Shaw & Co., Inc., testimony before the Web-based Education Commission, September 14, 2000)

Compare research in medicine and sports with research in education.

In medical research, cumulative, aggregated protocols, involving practitioners and patients, together with well-coordinated and publicized clinical trials, have led to treatments that enhance the health and extend the life span of many people. Technology has been central to studying diseases, to finding new solutions that address them, and to disseminating research results to medical practitioners and the public. Increasingly, technology has empowered an educated patient population to demand the best treatments. In short, research has made it possible to *enhance health.*

Sports research offers another example. Research employing new technologies has made it possible to enhance performance in athletics. Research on new designs and materials in golf clubs, skis, and bicycles, as well as new training feedback mechanisms (e.g., video replay), allows professional athletes and weekend sports enthusiasts to attain new levels of performance. Research using the latest technologies has made it possible to *enhance athletic performance.*

Educational research, focused on using long-term, longitudinal studies as well as aggregated short-term trials supported by technology, should be directed at *enhancing performance in learning.*

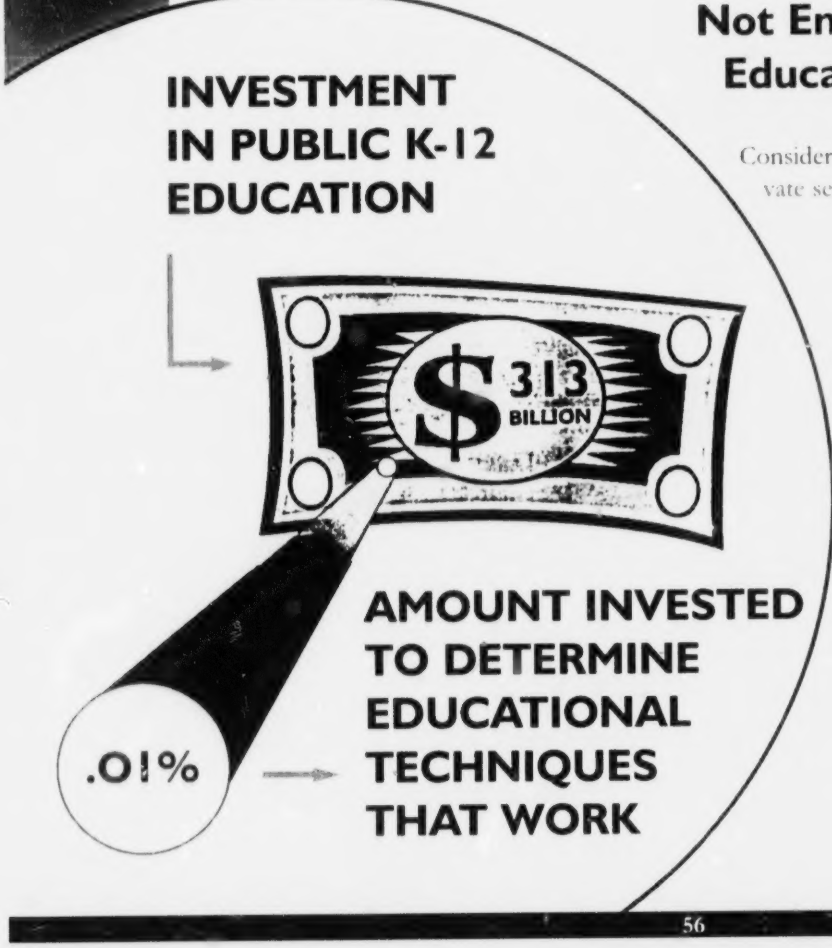
We know that technology offers both the impetus and the opportunity to vastly improve learning performance.[1] Without a vigorous, dynamic research base, however, we will miss the opportunity to advance the state of the art and science of education.

Educational research suffers from **three major problems**—

Not enough money is spent on educational research

Educational research often does not support enhanced learning performance

Educational research often is not accessible to teachers or easily translated into practice

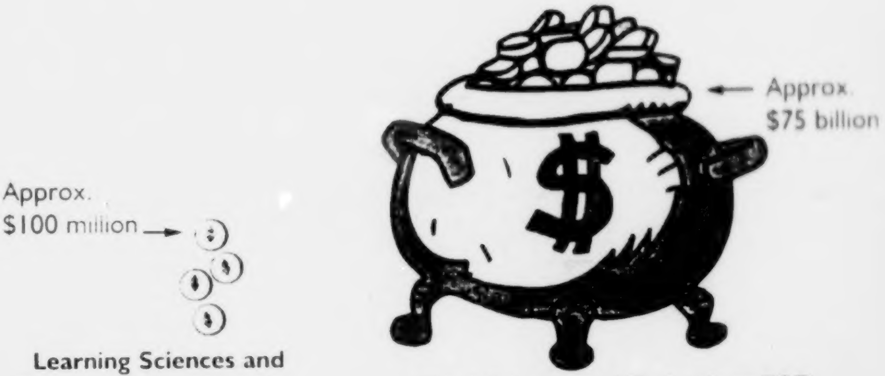

INVESTMENT IN PUBLIC K-12 EDUCATION
$313 BILLION
.01%
AMOUNT INVESTED TO DETERMINE EDUCATIONAL TECHNIQUES THAT WORK

Not Enough is Spent on Educational Research

Consider these comparisons between the private sector and the educational sector:

- **The U.S. Department of Commerce reports that "Between 1994 and 1999, total U.S. R & D investment increased at an average annual (inflation adjusted) rate of about 6 percent, up from roughly 0.3 percent during the previous 5-year period. The lion's share of this growth—37 percent between 1995 and 1998—occurred in Information Technology (IT) industries. In 1998, IT industries invested $44.8 billion in R & D, or nearly one-third of all company funded R & D."[2]**

FEDERAL TECHNOLOGY-RELATED R&D INVESTMENTS



Learning Sciences and Technology for Education

Total Science and Technology R&D

- **Last year, the United States spent about $77 billion on prescription and non-prescription medications, and invested approximately 23 percent, or nearly $18 billion, of this amount on research, development, and testing aimed at discovering new drugs and evaluating their effectiveness.[3]**

- **In the same year, our nation spent about $313 billion on public K-12 education, but invested less than 0.1 percent of that amount to determine what educational techniques actually work, and to find ways to improve them.[4]**

In its 1997 landmark report, the Panel on Educational Technology of the President's Committee of Advisors on Science and Technology (PCAST) recommended that "the federal government initiate a large-scale program of rigorous empirical research aimed at improving both the effectiveness and the cost-effectiveness of elementary and secondary education in the United States … at a level equal to at least 0.5 percent of the nation's aggregate K-12 educational spending, or approximately $1.5 billion per year at present expenditure levels."[5] We are a long way from this goal. Consider the following:

- **The current budget for the Office of Educational Research and Improvement, the major research arm of the U.S. Department of Education, is $540 million.[6] Even adding the $60 million spent by the Research, Evaluation, and Communication Division of the National Science Foundation's Education and Human Resources Directorate,[7] best estimates suggest total spending for education research is in the $600 million range.**

- **The federal government invests more than $75 billion a year in research in science and technology development in military, health, aerospace, agriculture, and other areas. Added to this are equivalent industry investments. It is obvious that R & D in these fields are mature. By comparison, the learning R & D field is in its infancy.[8]**

NEW TECHNOLOGIES/ NEW FORMS OF TEACHING AND UNDERSTANDING

- **Simulations, models, and visualization tools** can make it possible for students to bridge experience and abstraction, helping to deepen understanding of ambiguous or challenging content. For example, "Model-It" is a tool students use to create models that represent their theories about scientific phenomena.[11] "SimCalc" has made it possible for inner-city middle school students to learn pre-calculus with the aid of visualization tools for understanding functions.[12]

- The Internet opens the classroom door to **authentic issues and problems** that can form the basis of guided, reflective inquiry through extended projects. For example, in the GLOBE program[13] students conduct research and share their findings with other students as well as scientists seeking more data to answer problems related to the environment.[14]

- The public nature of the Web gives students a chance to share what they learn with others. Clarity and accuracy take on new meaning to students when they **share their products** with people outside the classroom. Teaching others is the most powerful way to learn, as students have demonstrated in the Web sites they create in the ThinkQuest competition.[15]

- The resources of the Web give students access to more information than is often found in textbooks, locating primary historical source materials, texts, artifacts, and works of art that are equal to the **resources used by real historians, scholars, and scientists.** In the "Culture of American History" course taught at the New School University, students can access Internet resources at the Smithsonian, the New York Historical Society, and other world-class institutions just by a mouse click. Students "become their own historians" by going right to primary documents and archival sources.[16]

- Web tools allow students to work with **resources and tools that are not available in their own schools.** For example, they can conduct experiments with online tools and simulated laboratories like those provided in the Concord Consortium's Molecular Workbench.[17]

- Web-based projects encourage students' **collaborative construction of meaning** through different perspectives on shared experiences. For example, through I*Earn's "Street's Children" Web project, students learn about and share their concerns around the issue of homeless children.[18]

Educational Research Should Lead to Enhanced Learning Performance

We are at a critical moment of discovery in the quest to "unlock the mysteries of learning." As reported in recent National Academy of Sciences reports, learning sciences have made substantial progress in the past 30 years, more than most people realize.[9] This expanding knowledge base about how we learn has important implications for improving education at all levels. And it is telling us something important: what goes on in schools is far from optimal for learning.[10]

We know from this research that learning environments should be centered around knowledge, learners, social interactions, and assessment. Instead, learning environments in school often:

- **Focus on the short-term recall of facts, rather than opportunities for deeper building of knowledge**

- **Organize around the top-down, teacher-and-textbook centered instruction, rather than the needs of the individual learner**

- **Limit social interaction to occasional times with peers in the classroom encouraging solo study, rather than collaboration**
- **Allow current assessment to influence instruction in ways that may not match the goals of 21st Century learning**

Schools often use technology to mimic this pattern of a top-down, lecture or text-driven model of instruction. Similarly, we have used the Internet in a narrow fashion, like vast textbooks or lectures online, instead of exploring its interactive potential.

Technology can support what we now know to be more effective learning environments. Interactive applications linked to the Internet can provide environments better matched to support learner-centered, knowledge-centered, community-centered, and assessment-centered conditions for learning.

New technological tools and applications allow for expanded forms of communication, analysis, and expression by students and teachers. These innovations support new forms of teaching and understanding built on the early findings of learning research.

Building the Foundation for 21st Century Learning Goals

Perhaps the greatest barrier to innovative teaching is assessment that measures yesterday's learning goals. It is a classic dilemma: tests do a good job of measuring basic skills, which, in turn, influence the teaching of these skills so students can score well on the tests. Testing works well so long as we are testing the right things.

Learning frameworks at the K-12 level are important for providing a common definition of what is valued, but often they are built around collections of content rather than demonstrations of higher-order cognitive, affective, and social skills vital in a knowledge-based economy. Most states use standardized tests for determining how well students meet these frameworks at several grade levels.

Witnesses before the Commission made it clear that academic standards are important, but they must be connected to the needs of the 21st Century. Often this is not the case. Too often today's tests measure yesterday's skills with yesterdays' testing technologies—paper and pencil.

What will it take to develop tests that truly reflect what students need to learn for the 21st Century? It will take a concerted effort and large amounts of R & D funding with the collaboration of educators and psychometricians, content specialists, and technologists. Above all, it will take a focus on the potential of technology to help us better measure the knowledge, competencies, and understandings we value in education.

The same kinds of innovative 21st Century tools and learning environments that people are developing for teaching and learning can be designed to administer and score student performances.

Advances in testing technologies have made it possible to extend test item formats beyond the selected-response formats of past test designs. For example, through web-based testing a student may be asked to place works of art along a timeline, to design a building to meet a set of constraints, to troubleshoot a faulty system, or to analyze a text and compare it for historical accuracy with other documents of the same era.

In computer adaptive testing, the test "adapts" to the examinee's performance on it. The individual is given a question, and, if answered correctly, moves on to more difficult questions. Incorrect responses generate less difficult questions. Information is stored on the computer and the score reflects the skill level he or she has achieved. The use of computer-adaptive testing is growing in the military and training fields, and for professional certification (Medical Licensing Examination) and graduate admissions testing (e.g., Graduate Record Exam and Graduate Management Admissions Test).[illegible]

With storage and delivery capabilities of the Web, it is now possible to provide web-based test administration. A central server may contain an "item bank" of thousands of questions of varying types and difficulty levels. Students could take the tests from their classroom or computer lab, with the delivery of items adapted to the students' performance. Scoring could be immediate, and administrators and teachers could have access to this information at any level—aggregated by school, grade level, classroom, individual student, or even concept area. This feedback could provide much better monitoring of achievement at all levels, and, unlike today's large-scale assessments, make it possible for teachers to adapt instruction in response to commonly found difficulties, or an individual student's learning profile.[illegible]

The use of information technologies, for both teaching and assessment, afford new opportunities for an increased focus on the application of knowledge, not just its rote recitation. Assessment of student performance can be embedded, almost seamlessly, in systems that promote continuous learning.

However, the current forms of testing are not designed to measure how educational reforms, including those based on technology, can improve student understanding. This mismatch between reforms and testing leads many to underestimate the impact of technology. It discourages educators from spending the effort to undertake these reforms and changes in practice.

Fortunately, development of sophisticated test construction, delivery, and scoring through new technologies will make it possible to do a better job of evaluating the skills we seek to build.

Educational Research That Teachers Value

Too often educational research has been seen as esoteric, faddish, or too far from the realm of the day-to-day to have meaning. It takes too long, and is too little used.

In part, this reflects the isolated researcher in the university community who may not be connected with K-12 schools, or even the teacher education programs in his or her own institution. The highest forms of knowledge-building today are those that come through collaboration and sharing of what is known, just as medical research pulls together relevant specialties (from genetics to infectious diseases, neuroscience, pharmacology, or radiology) in exploring a problem and potential ways of addressing it.

Similarly, research on learning will need to draw on specialists in neurocognition, behavioral and biological sciences, and other fields, as well as the expertise of content area specialists, educational practitioners, designers, and technology developers to create the applications that carry research findings into the classroom. And teachers can now be more a part of the process, as the Internet links them to the world of the researcher, making classrooms more likely settings for research and for implementation of research findings.

Witnesses before this Commission called for such "mission-oriented" research, combining basic and applied research, designed to yield fundamental new knowledge while exploring problems that have important practical consequences. And this research should focus on problems of practice faced daily by teachers and administrators—research for real-time practice, not just research on practice.

Imagine if schools, on demand, could apply research technologies to profile what a student needs to learn, how he or she learns best, what his or her learning style is, and what worked or did not work in the past, with continuous feedback to teachers, parents, and the student.

The Internet, with its tools for collaborative research and immediate communication, makes it possible to create new models of knowledge-building communities that can support and quickly implement new forms of research, innovation, and application.

POTENTIAL BENEFITS OF WEB-BASED TESTING:

- **Time and cost savings in test administration and scoring**
- **Greater score precision**
- **Maximized student engagement, minimized student frustration in taking tests that are too difficult or boredom in taking tests that are too easy**
- **Improved test security**
- **Greater opportunity to evaluate progress over time and to use test results to influence instruction**
- **Possibilities for new kinds of questions, using multimedia, simulations, and other resources to assess sophisticated learning goals (e.g., problem-solving, visualization, and modeling)**

MAKING THE WEB ACCESSIBLE FOR STUDENTS WITH DISABILITIES

No group is more likely to benefit from web-based education than people with disabilities.

Learning over the Web can minimize the impact of disabilities by eliminating transportation barriers. It can allow students to reveal their disabilities at their discretion. It can promote equality among learners, with and without disabilities, reducing potential discrimination. And it can make previously inaccessible classroom materials accessible.

In short, people who are blind, deaf, or who have mobility impairments can overcome numerous educational and vocational barriers if online educational materials are produced in a way that makes them accessible.

Techniques and technologies are already in place for assuring such accessibility. What is missing is public awareness of these standards and policies to guarantee that they are followed.

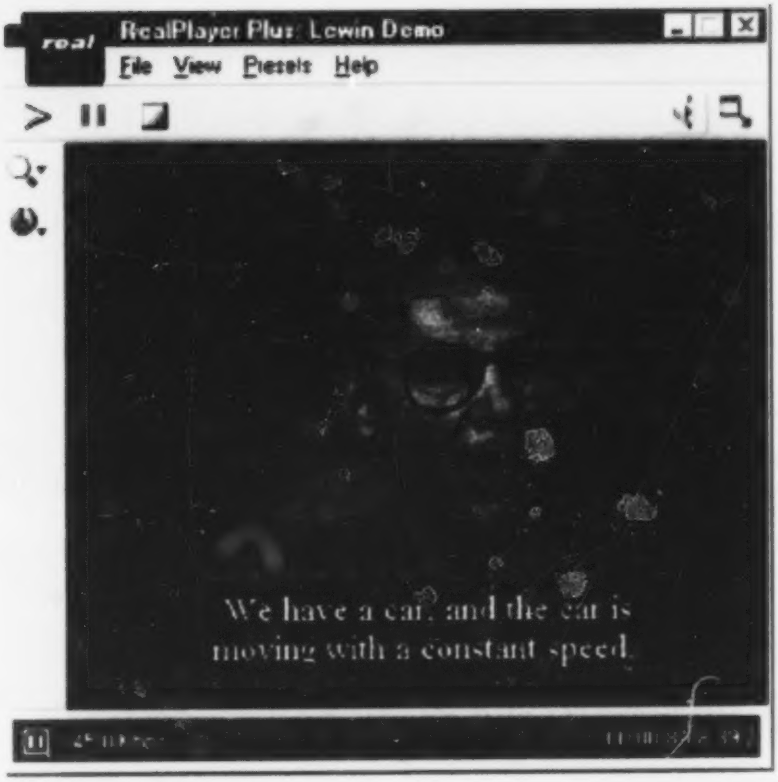
A powerful example of accessible design can be found in the new web-based multimedia physics curriculum called "Physics Interactive Video Tutor" (PIVoT)[1] created by the Massachusetts Institute of Technology (MIT). PIVoT is designed to provide freshman students with a virtual learning environment that offers the immediacy, responsiveness, and dynamism of a traditional tutor.

As part of PIVoT's activities, the Corporation for Public Broadcasting/WGBH National Center for Accessible Media (NCAM)[2] is collaborating with MIT on a three-year project funded by the National Science Foundation and the Mitsubishi Electric America Foundation. Launched in January 2000, this project is using PIVoT as a model to test, implement, document, and promote the development of multimedia access solutions that will make distance-learning accessible to blind, low-vision, deaf, and hard-of-hearing students.

To understand the PIVoT approach, it is important to first understand why so much web-based material is difficult for disabled students to access.

Web browsers present information through software known as a graphical user interface (GUI). Navigation through GUIs is difficult for blind and visually impaired people because image maps, buttons, menus, and other controls are often invisible or nameless when accessed by a blind user's assistive technology, such as a screen reader or refreshable Braille display.

Access to most graphical content (such as drawings, photos, or image maps) must be provided via technical instructions known as "alt-text tags." The PIVoT web site is becoming a model of accessible Web site design and is striving for adherence to the Web Content Accessibility Guidelines of the World Wide Web Consortium's Web (W3C) Accessibility Initiative[3]



We have a car, and the car is moving with a constant speed.

PIVoT supports disabled users in the following ways—

- **First, it offers better design and layout.** NCAM is working with PIVoT designers to improve the Web site's layout so that blind users can more easily navigate the site. For example, designers have improved text/background contrast to help visually impaired students use the site more effectively.

- **Second, it offers access to tables.** Reading and manipulating tables is an important way of processing scientific information—but tables present a particular problem for blind users. Tables require that the user refer to both row and column headings in order to interpret the information in a single cell. The PIVoT Web site is being designed to permit blind users to explore a set of tabular data more efficiently through cues that help them understand these relationships.

- **Third, it offers access to math equations.** Improving access to equations and graphs is crucial in making math and science accessible to blind and visually impaired students. A promising standard is the MathML specification from the W3C. A discussion is underway regarding appropriate MathML browsers in conjunction with the User Agents Working Group of the Web Accessibility Initiative. Once tools are available for authoring MathML, the PIVoT project intends to use them to prepare physics materials for the Web. This solution should enable blind students to read and manipulate equations with output in speech and Braille.

- **Fourth, it offers access to multimedia.** The MIT development team has elected to use the W3C's Synchronized Multimedia Integration Language (SMIL) to assemble and present the course's multimedia lectures and help files. NCAM's caption-authoring tool, the Media Access Generator (MAGpie), is being used in the PIVoT project to add captions to multimedia, thus simplifying the process of making these clips accessible to deaf and hard-of-hearing students. MAGpie can also sequence audio descriptions into SMIL presentations, making them more accessible to blind or visually impaired students.

When implemented from the start, accessibility features such as alt-text tags, captions, audio descriptions, and proper layout add little if anything to the cost of a Web site. However, when implemented as add-ons, after the site has been launched, considerable costs related to labor and time may be incurred as the site is retrofitted to accommodate specific features.

It is important to consider that accessibility improvements benefit all users, not just those who are disabled. For example, Web users who are not sight-impaired may turn off their browser's automatic image-loading feature to make use of alt-text tags to identify and manipulate images. All users have the option of using captioned multimedia when viewing movie clips in a noisy environment, or where the use of sound is not appropriate. Caption (text) tracks are also useful as indices for searching through large collections of digital video files—the captions act as keywords.

Within three years, the PIVoT project aims to:

- **Enable science-focused high school and college students who are blind, visually-impaired, deaf, or hard-of-hearing to participate in an innovative and challenging web-based introductory physics curriculum**

- **Provide developers, publishers, and distributors of distance-learning and educational multimedia with recommended practices and an applied demonstration of accessible design principles for network-delivered multimedia**

- **Enable the MIT Center for Advanced Educational Services[4] to institutionalize the technical capabilities developed through this project to develop a range of future educational products that are accessible to individuals with disabilities**

Through the application of pragmatic and common sense design and development standards it is possible to provide the enormous benefits of accessible online learning equally to all students.

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[1] http://www.wgbh.org/wgbh/pages/ncam/webaccess/Pivot/PIVoToff.htm

[2] http://www.wgbh.org/ncam

[3] http://www.w3.org/WAI

[4] http://caes.mit.edu/

E-LEARNING: THE MEDICAL MODEL

While educators and policymakers talk about e-learning, the medical profession is doing it.

Elliott Masie,[1] a technology and training expert, saw this first-hand when he was invited to see what he calls "a truly breakthrough example of e-learning."

Imagine a conference hall with 7,000 cardiologists watching and interacting with surgeons conducting heart surgery simultaneously in 3 countries around the world. Six patients were prepared for cutting-edge heart procedures in operating rooms in Israel, Italy, and New York City. Each operating room had 3 to 8 TV cameras and scanning equipment to show these operations live and give internal imaging views.

The cardiologists in each operating room were pushing the edge of current practice, doing very complicated procedures that were far more advanced than standard approaches. Several of the patients had quite complicated and serious conditions, but all had signed consent agreements, and, in fact, were awake and respondent during much of the procedure.

A satellite feed and connection allowed the viewers to communicate live and interact with the doctors during the process, as well as track various instrument read-outs. A "reaction panel" comprised of top cardiologists expressed different views and opinions about the procedures underway. The doctors in the audience used response keypads to vote in real time on what procedure they would do or whether they would continue or stop an action. As voting was underway, four screens filled with real-time data that helped the group place what was happening into context.

"It was a deeply powerful learning experience," Masie reported. "The process supports very rapid dissemination of medical information and knowledge, quite faster than the normal medical publishing process." Masie said that the virtual operating room allowed approved trials to be witnessed in real time and disseminated instantly.

"The group process fostered an incredible amount of discussion and conflict that brought forth a level of intellectual dialogue on best practices that I have rarely seen in other professions," he said. "The group voting process seemed scary to me at first, but actually gave some feedback to the doctors in the operating rooms and placed the learner's risk-taking process in perspective. The intensity of side-dialogues was amazing, as we watched and reacted in small peer conversations alongside the real time group interaction."

Masie added, "The international perspective gave a global element to the entire learning experience and we were able to see very different attitudes toward similar innovations in diverse cultures . . . The use of research to frame the discussion was powerful, as we were seeing a multi-dimensional view of the points of conflict."

Did the patients mind? Masie reports that the outcomes and survival rates for this process are higher than normal procedures. Do all doctors approve of this model of medical knowledge transfer? No, there are some that are quite opposed. Was the live element necessary?

"I think it added greater levels of learner attention and made the experience quite real versus simulated," he said. "I was jealous. I wondered when the learning and training profession would have this level of an open and intense discussion about what actually works and does not work in each e-learning genre."

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[1] http://www.masie.com

ENDNOTES

1. See, for example, "Selected Examples of Research on the Effectiveness of Educational Technology" in *eLearning: Putting a World-Class Education at the Fingertips of All Students*. United States. Department of Education, Office of Educational Technology. Washington, DC. Prepublication draft. November 2000.

2. United States. Department of Commerce. *Digital Economy 2000*. Buckley, Patricia, Sandra Cooke, Donald Dalton, Jess Dumagan, Gurmukh Gill, David Henry, Susan LaPorte, Sabrina Montes, Dennis Pastore, and Lee Price. Washington, D.C. 2000. http://www.esa.doc.gov/de2000.pdf

3. Shaw, David, D. E. Shaw and Co, Inc. and Juno Online Services. Testimony to the Web-based Education Commission. September 14, 2000. http://www.webcommission.org/directory

4. Ibid.

5. Ibid.

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7. National Science Foundation. *Summary of FY 2001 Budget Request to Congress*. Data from the Education and Human Resources Directorate's 1999 fiscal year allocation for Research, Evaluation and Communication. 2000. http://www.nsf.gov/bfa/bud/fy2001/ehr.htm

8. Arizona Learning Technology Partnership. e-Testimony to the Web-based Education Commission. August 31, 2000. http://www.webcommission.org/directory

9. See, for example, National Research Council. *How People Learn: Brain, Mind, Experience and School*, 1999; *How People Learn: Bridging Research and Practice*, 1999; and *How People Learn*, Expanded Edition. 2000. National Academy Press. Washington, D.C. 1999-2000. http://www.nap

10. Bransford, John D., Vanderbilt University. Testimony to the Web-based Education Commission. September 14, 2000. http://www.webcommission.org/directory

11. For more information, see http://www.hi-ce.org/sciencelaboratory/modelit/index.html

12. For more information, see http://tango.mth.umassd.edu

13. For more information, see http://www.globe.gov

14. Another example is "Hands-On Universe", an educational program that enables students to investigate the universe while applying tools and concepts from science, math, and technology. http://hou.lbl.gov

15. For more information, see http://www.thinkquest.org

16. For more information, see http://homepage.newschool.edu/~johnsonc

17. For more information, see http://www.concord.org/projects/index.html

18. For more information, see http://www.iearn.org

19. Bennett, Randy. e-Testimony to the Web-based Education Commission. July 24, 2000. http://www.webcommission.org/directory

20. Ibid.

BEST COPY AVAILABLE

COMPELLING ONLINE CONTENT

Quality of Content

The real revolution now taking place is not the hardware of technology, but the intellectual technology of information, communication, and the augmentation of human intelligence.

All too often, discussions about web-based learning tend to fall back on a simplistic faith in the power of technology. Of course interactivity is a powerful draw for teachers and students alike. But dazzling technology has no meaning unless it supports content that meets the needs of learners.

Some of the content currently available on the Web is excellent, but much of it is mediocre. Challenges await content developers and educators in producing, distributing, cataloging, indexing, and evaluating good online content. They must address gaps in this market, find ways to build fragmented lesson plans into full courses, fully develop the promise of postsecondary educational opportunities on the Web, and assure quality in this new environment.

> "Students conditioned by the dynamic imagery of communication media, particularly television and digital games, expect to learn in an environment that takes advantage of visual and auditory stimulation and interaction."
>
> (e-Testimony, Susan Metros, Innovative Technology Center, University of Tennessee, August 20, 2000)

State of the Market

The educational content market is a huge business. Total U.S. spending each year on textbooks and instructional technology content (e.g., software and online course materials) amounts to approximately $4 billion. Online content currently represents only a fraction of that market, although many expect the Internet to both capture a large share from offline content sources, such as textbooks, as well as expand the size of this market overall.[1] According to one report, 13 percent of K-12 schools already subscribe to online curriculum.[2]

Traditional content providers—publishers and software developers—are increasingly joined by new providers of online content. Federal agencies, museums, teachers, and even students themselves are contributing to web-based content. Much of the online content consists of data, Web pages, applets, and other information that teachers use as supplements to text-based teaching, rather than full courses. For example, the U.S. Department of Education sponsors the Gateway to Educational Materials, containing more than 14,000 lesson ideas and learning resources from over 200 organizations.[3]

Many private-sector providers have changed their focus from producing content to aggregating instructional information, acting as a "portal" or access point for other content-based resources and information provided by teachers and schools. For example, bigchalk.com aggregates "best of class" content and makes it available to subscribing schools through community Web sites.[4]

However, only a handful of providers have been able to take advantage of the online education content market. That is because the market is highly fragmented (products and services are targeted by age, grade, and subject matter and marketed to over 15,000 school districts) and often finite (demand tends to be limited to the number of students taking any given class at any given time—the number of 7th graders taking Algebra in the U.S. in 2000, for instance). The cost to compete in these specialized sub-markets is high, forcing many providers to retreat and instead produce "big ticket" general studies content (usually in the K-6 range) that historically have provided a greater rate of return.

K-12 ONLINE CONTENT IS AVAILABLE TODAY FROM A RANGE OF PUBLIC SECTOR PROVIDERS

PUBLIC SECTOR CONTENT PROVIDERS	BENEFITS
Federal Agencies	· Expertise · High quality materials
Museums and Science Centers	· Priceless, unique, original resources · Expertise · At any time a museum has 5% to 10% of its collection on exhibit · 59% of museums in recent survey have/are developing classroom materials via Web site
Professional Organizations	· Linked to content standards · Teacher input
Teachers	· Range of teacher experience · Resources organized, filtered for educational appropriateness (grade level, quality, etc.)
Students	· Creativity · Student focus · Student initiative valued · High standards if juried

As a result of this fragmented and finite market, there are areas where online content produced by the private sector is of limited quality or quantity. And, because the content is generally produced to match state academic standards or the assessments of major testing programs, it may reflect a limited emphasis on inquiry learning, project based activities, or collaborative learning models.

There are gaps in specific subject areas as well—in foreign language materials, higher level courses in math and science, and other thin markets. Moreover, much of the online content fails to address the interests of cultural or ethnic groups. One survey, for example, found that only 2 percent of Web sites target Americans who do not speak English as their first language. In the same survey, only 6 percent of low-income users reported finding content that met their needs.[5]

LIMITATIONS	EXAMPLES	URL
Materials may not be developed for student audiences	• NASA Learning Technologies Program • Library Of Congress American Memory • Free Federal Resources for Educational Excellence • U.S. Department of Education Gateway to Educational Materials	http://learn.ivv.nasa.gov http://memory.loc.gov http://www.ed.gov/free http://thegateway.org
Cost of digitizing collections is high	• St. Louis Science Center • American Museum of Natural History • The Exploratorium • Museum of Fine Arts, Boston	http://www.slsc.org http://www.amnh.org http://www.exploratorium.edu http://www.mfa.org
For some the only criterion for inclusion is a recommendation by site visitors	• National Science Teachers Association • National Education Association	http://www.nsta.org http://www.nea.org
Issues of quality control and intellectual property rights for non-juried submissions	• Mrs. Rennebohm Franz's Classroom • Mr. & Mrs. Donn's Ancient History Site	http://www.psd267.wednet.edu/~kfranz http://members.aol.com/donnandlee
Issues of quality control and intellectual property rights for non-juried submissions	• ThinkQuest	http://www.thinkquest.org

VIRTUAL HIGH SCHOOLS AND COURSE PROVIDERS

ONLINE COURSE PROVIDER	FUNDING MODEL	NUMBER OF COURSES
Florida Online High School **http://fhs.com**	• $6.2 million this year from state funds • Students enroll through their local high school or private school, or as home school student	56 courses
Kentucky Virtual High School **http://www.kvhs.org**	• Districts pay $275 per half credit (half Carnegie unit) per student per semester course • Students can apply either on their own or through their guidance counselors • Also open to private, home school, and middle school students	35 courses
class.com **http://www.class.com**	• Affiliation with the University of Nebraska, Lincoln's Independent Study High School • Students take courses individually for credit transfer to their local high school or as part of a full high school diploma program	48 courses
Concord Consortium Virtual High School **http://vhs.concord.org**	• U.S. Dept. of Education Challenge Grant • Also private sector sponsors • Up to 20 students may enroll per course • Beginning in Fall 2001, a school membership fee will apply	156 courses in Fall 2000 175 courses in Spring 2001
APEX Learning **http://www.apexlearning.com**	• $395 per student per course, paid by state, district, or private school • Discounts offered for quantity sign-up	10 Advanced Placement courses; also online exam review

SCOPE OF SERVICE	NUMBER OF STUDENTS	TEACHERS	ACCREDITATION
Florida (plan to serve outside Fla. on a per student/per course arrangement through licensing with other states/districts)	• Approximately 5,000 students	• 55 teachers, most full-time, certified in Florida	• Program accreditation possibly in place by Fall 2001 • Courses count toward student graduation
Kentucky	• 300 students	• Certified by Ky. in specific content areas; average 16 years experience • Part-time—comprised of current high school teachers or retired teachers	• Through students' schools
National and international	• 6,000 students	• 12 online instructors in addition to 12 curriculum developers and 18 involved research and development • School districts and state organizations can provide class.com courses locally	• North Central Association of Colleges and Schools via the Independent Study High School • ISHS diplomas are recognized by higher education institutions
National and international	• 2,500 students in Fall 2000 • 3,000 students in Spring 2001	• 156 teachers plus 50 additional teachers currently in training • The VHS course is part of teachers' full-time teaching load at school where they teach	• Not applicable - VHS provides extended offerings of participating schools
National and international	2000 Fall: • 2000 students in AP courses • 8,000 students in online courses and exam review	• 32 online instructors • High school teachers with AP experience, and college faculty	• Accredited by the Commission on International Trans-regional Accreditation • Schools grant students' credit based on performance on the AP exam; colleges may also grant AP credit

> " 'What did the student learn?' is far more important than 'How was the information presented?' "
>
> (e-Testimony, Distance Education and Training Council, August 18, 2000)

School districts and states may soon be faced with a paradox. Overall market growth, along with expansion of the delivery mechanism (i.e., the Internet), may not, by themselves, be enough to sustain robust competition and innovation in product design, capability, and customization.

Unless school districts and states create significant demand for innovative online learning materials, it may not be economically feasible for many online education content providers to stay in the business. The result could be a latter-day online equivalent to the current K-12 textbook market—domination by just a few providers, limited choice, and perhaps, stagnancy in innovation and design.

The good news, however, is that some states are beginning to respond by investing in approaches that provide web-based content for educators, when and where they need it.

The Massachusetts' Virtual Education Space (VES), for example, will provide every K-12 student, teacher, and parent a personal "workspace" they can log onto with an Internet browser and personal password. Students will have access to assignments, content linked to their specific learning objectives, works-in-progress, and portfolios of completed work. Teachers will be able to access state and district curriculum standards related to their teaching areas, and a database of content and lesson plans linked to the standards. Collaboration, planning, administration, and assessment tools will also be at the teacher's access. Parents, too, can access their children's assignments, work to date, and teacher evaluations of progress.

Washington State is partnering with Massachusetts, developing its own version of this program called WAVES. Several other states (New York, Oregon, Wisconsin, and New Jersey) are discussing working together in development of similar "smart desktops". Some school districts have developed their own instructional management systems that use the Web to help teachers organize and manage instruction more effectively and efficiently. Fairfax County Public Schools in Virginia testified that it is investing upwards of $100,000 to develop several web-based high school courses for its students.

PreK-12: Moving From Online Materials, to Courses, to Full Programs

While there are thousands of online lesson plans and supplementary course materials at the preK-12 level, full courses are more limited. Most have been developed by state, district, or cross-regional online high schools.

State-created online high schools offer courses that parallel those required in the traditional high school curriculum of the state. As more states are developing virtual high schools, (e.g., Alabama, Florida, Kentucky, Maryland, Nebraska, New Mexico) a greater range of courses are being offered online.

Another model is the Virtual High School (VHS) Project funded through a U.S. Department of Education Challenge Grant to the Hudson, Massachusetts School District and operated by the Concord Consortium. VHS offers over 156 courses to about 250 schools in 32 states and 13 countries. Many of these courses are taken as electives rather than core curriculum requirements. At VHS, the per student tuition fee can be waived if a school creates an online course or facilitates a section of a course that students in any participating school can take. Course design is structured around VHS guidelines and practices taught to teachers through their required participation in the yearlong VHS teacher developer course.

Advanced Placement (AP) courses are an important gateway helping to prepare students for college. Many schools do not have either the in-house expertise or enough students to warrant hiring a teacher to offer advanced placement courses. Today only 60 percent of high schools offer AP courses, with the average high school offering only about 5 AP courses out of 32 subject areas. A private sector provider, APEX Learning, is providing courses in 10 AP subjects online, as well as other services like AP preparatory materials online.

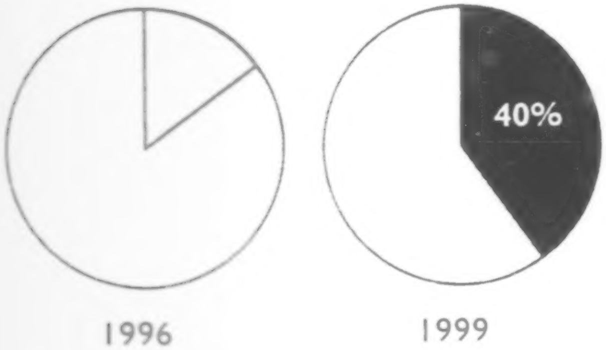
Evaluation of preK-12 online courses follows the model of traditional education. That is, these courses are certified by the home state or regional accrediting body with jurisdiction in that state. This task becomes considerably more complicated in the case of courses offered across state lines. Assessment requirements, teacher credentialing, and the granting of credits have all been areas of individual state policy. This means that an offering entity may have to traverse a complex maze of accreditation standards that can vary from state to state.

Online Content and Courses at the Postsecondary Level

At the postsecondary level, there is a growing use of online content and tools for both traditional courses and those taken at a distance.

- **Nearly 40 percent of all college classes used Internet resources as part of the syllabus in 1999, compared with 15 percent in 1996.**
- **More than 25 percent of all college courses have a Web page compared with 9.2 percent in 1996.**
- **Three-fifths (59.3 percent) of all college courses now utilize electronic mail, up from 54.0 percent last year, 44.0 percent in 1998, and 20.1 percent in 1995.**
- **Similarly, two-fifths (42.7 percent) of college courses now use Web resources as a course component, up from 10.9 percent in 1995, 33.1 percent in 1998, and 38.9 percent in 1999.**

PERCENTAGE OF ALL COLLEGE CLASSES USING INTERNET RESOURCES AS PART OF THE SYLLABUS



- **Almost one-fourth (23.0 percent) of all college faculty have a personal Web page not linked to a specific class or course, compared with just 19 percent in 1999.**

Instructors add online resources to their classes to:

- **Make readings, original sources, or specialized materials more easily accessible to their students.**
- **Encourage more out-of-class student reflection and interaction among students or with the instructor.**
- **Meet the expectations of students who increasingly anticipate that courses will be supplemented with online materials or discussions.**

Quality of Content

The greatest technological concern of higher education faculty, like that of K-12 teachers, is finding the best ways to integrate technology to enhance their classes. And for them, like their K-12 colleagues, training is essential for addressing the special requirements of integrating web-based learning tools and applications.

First, the online faculty themselves must be comfortable using the available communications technologies. They also need assistance in designing courses that take full advantage of the medium, and the strategies and skills to communicate with students electronically in the absence of visual and oral cues.

Creating a course for online delivery can take much longer, anywhere from 66 percent to 500 percent longer than creating traditional courses, and costs are widely variable.[12] Even adding online components to an existing course takes time. And it adds a new set of risks: teachers, department chairs, and deans must be prepared for negative course evaluations from students as the faculty experiments with these new approaches.

Faculty must be prepared to be available to their students for online communication—answering questions and grading online materials promptly and assuring that students stay connected to the class. Institutions must be prepared to provide faculty with tools and assistance for appropriate online instructional design.

Additionally, faculty that have not yet acquired tenure often shy away from using technology creatively in their courses because it may be viewed as a distraction from their "primary tasks" of research, scholarship, and publishing.

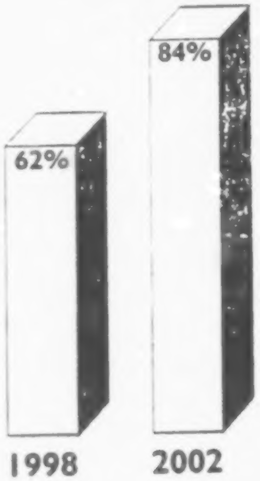
Rather than "reinventing the wheel," higher education institutions are forming collaborative groups to assist faculty in finding and developing quality online teaching materials for courses. The Multimedia Educational Resource for Learning and Online Teaching (MERLOT)[13] is a collection of online learning materials and support resources to help faculty enhance instruction. Membership is open and free; faculty submit materials to 12 discipline committees responsible for developing evaluation standards, conducting peer reviews of learning materials within a discipline, and making connections with their professional organizations.

Growth is just as dramatic in courses developed entirely for online delivery:[14]

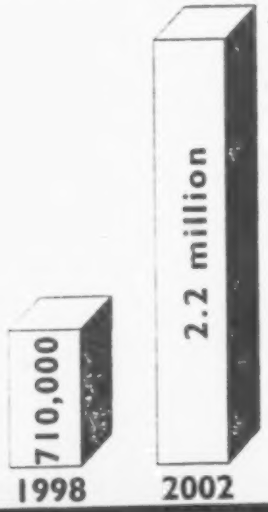
- **Approximately 84 percent of four-year colleges are expected to offer distance learning courses in 2002, up from 62 percent in 1998.**
- **Today U.S. colleges and universities offer more than 6,000 accredited courses on the Web.**
- **In 2002, 2.2 million students are expected to enroll in distributed learning courses, up from 710,000 in 1998.**

While traditional site-based institutions are adding distance learning courses to their offerings, new players are exploiting the burgeoning demand for online educational courses and programs. They realize that the market is no longer limited to the students who can come to the campus. With 15 million students enrolled in higher education in the United States, and another 84 million students enrolled in higher education around the world, there is a substantial market for bringing courses to the students, rather than students to the courses.[15] Some online providers are offshoots of existing public institutions while others are private institutions funded through public companies. Still others are "born on the Web" virtual institutions that leverage the power of the Internet and operate entirely online.

FOUR-YEAR COLLEGES OFFERING DISTANCE LEARNING COURSES



STUDENTS EXPECTED TO ENROLL IN DISTRIBUTED LEARNING COURSES



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Assuring High Quality at the Postsecondary Level

How is the quality of online course and program content to be assured in this arena of new providers, new pedagogical techniques, and new course designs?

There is widespread agreement that web-based courses should be held to the same high standards required of traditional courses and programs. Public higher education institutions receive their accreditation from regional accreditation agencies (New England, Middle States, Southern, North Central, Western, and Northwestern). The Distance Education and Training Council is one of the major national accrediting associations for a range of public and private distance education institutions. While program accreditation is voluntary, the accrediting agencies set high standards and include a comprehensive study aimed at assuring that a program meets the educational goals it has set for students and faculty.

While voluntary accreditation and self-regulatory agencies are an important quality control mechanism for web-based learning, there are a number of areas that national, regional, and specialized accreditors should address in the future, including:[16]

- **Determining whether new accreditation review standards and practices are needed and developing these tools where appropriate**
- **Providing assistance to institutions, programs, and new providers to develop internal quality review procedures for web-based learning**
- **Exploring whether and how the regional accrediting agencies should expand beyond their traditional focus on non-profit institutions to include more for-profit institutions**
- **Developing an improved capacity for course accreditation to accompany institutional and programmatic accreditation**
- **Strengthening coordination among accreditors to respond to web-based learning with agreed upon standards**
- **Creating partnerships for review of web-based learning where appropriate with other external quality reviewers**

Two major concerns about program accreditation loom above all others. One is measurement: quality assurance has too often measured educational inputs (e.g., number of books in a library, number of Ph.D.s on the faculty) rather than student outcomes. The other is federal regulation that is tied to funding of students or eligibility for Title IV student financial assistance based on these input measures. (See following section for a full discussion of these regulatory issues).

The situation is further confused by a lack of commonly understood criteria of what constitutes accreditation. There are both illegitimate distance education "colleges" and disreputable "accrediting" agencies. It is difficult for members of the public to distinguish between these accrediting agencies and the quality control they provide. This suggests developing greater public awareness through consumer education programs. The U.S. Department of Education could take the lead by supporting consumer awareness programs that identify recognized accrediting agencies, and by publicizing and explaining their standards. Legislative language in the 1998 Higher Education Act Amendments confirms congressional support for a voluntary system of accrediting higher education institutions and programs, but the range of programs and new providers suggests the need for better clarity in what accreditation means for the consumer in this new era.

The Bottom Line Test: Does it Work?

One question gets to the heart of the content quality issue: Is online learning as effective as other forms of learning? According to a recent review of contemporary research on the effectiveness of distance learning in higher education,[77] the short answer is "yes." Distance learning courses compare favorably with classroom-based instruction and enjoy high student satisfaction.[78] Based on a limited number of studies that take into account student outcomes (grades and test scores) and satisfaction, students in distance learning courses perform as well as their counterparts in traditional classroom settings, earn similar grades or test scores, and display the same attitudes toward the course.

But the caveat with this study is one heard in much educational research: the research base is limited and has shortcomings both in scope and methodology. Although more research is needed, the field has begun to develop benchmarks for evaluating effective distance learning programs. For instance, an Institute for Higher Education Policy report recently developed for the National Education Association and Blackboard, Inc. identifies 24 benchmarks that are necessary to ensure quality in Internet-based distance education. These benchmarks are grouped around the following topics: institutional support; course development; teaching/learning process; course structure; student support; faculty support; and evaluation and assessment.[79]

TELECOM WORKERS: OVERCOMING EDUCATIONAL "BUSY SIGNALS"

Completing course work and obtaining a degree while you are working and raising a family is a hard task for anyone. But doing it when your work schedule includes unexpected overnights on the job is almost impossible!

Telecommunications workers face this problem. Mandatory overtime is common in this industry; when the system goes down, nobody goes home, or anywhere else. Coming to terms with this situation, in an industry where upgrading skills is a necessity, requires a unique partnership.

The Sloan Foundation,[1] which had for years provided grants to universities to assist them in developing online courses, recognized that the telecommunications industry was an obvious target for web-based learning. In 1998 Sloan gave a grant to the non-profit Center for Adult and Experiential Learning (CAEL).[2] CAEL convened meetings with representatives of the existing major telecommunications companies (NYNEX, Bell Atlantic, U.S. West, Ameritech, and SBC) and unions (Communication Workers of America and International Brotherhood of Electrical Workers). The meetings led to building a curriculum, agreement on a governance structure, and identification of an educational institution—New York's Pace University—to provide an online Associate of Science (A.S.) degree for industry workers and those entering the industry.

The result is the National Coalition for Telecommunications Education and Learning(NACTEL).[3] The first NACTEL classes were given in 1999, and approximately 2,000 learners have taken classes so far, with a goal of 5,000 students by the end of 2001. Course completion rates are over 80 percent, equivalent to on-campus results for the same courses, and learner satisfaction is high.

Frank Mayadas, the Sloan Program Director, points out that the online learning model has as much potential for workforce learning as for traditional degree programs. "The workforce of tomorrow will have to be better trained and better able to access education, training, and other knowledge resources," he says. "The Internet provides the ideal mechanism for this access. Some of the necessary courses, certifications, degrees, and other kinds of knowledge modules are available today, but not many and not enough. Many more are needed."

Pam Tate, President of CAEL, says that if "you can organize industries and unions to coalesce around common goals, then partner with universities and community colleges, this creates a wonderful feeder mechanism to bring adults in and support lifelong learning."

Tate adds that the biggest barriers to adult learning are money, time, and fear. With corporate financial assistance and online, anytime availability, two of the barriers are minimized. CAEL has organized a mentoring program to help people who have never worked with computers test the waters. Potential students gain computer skills and become part of the peer network, supporting one another.

"I've been in education for 17 years," says Dr. David Sachs, Assistant Dean of the School of Computer Science and Information Systems at Pace University. "What intrigues me about NACTEL is the incredible ability to reach people who normally do not have access to education." Sachs points out that what NACTEL supplies is not so different "from what the students would get if they showed up on campus—but they can't show up on campus."

Students work toward an A.S. in Applied Information Technology Telecommunications. It is equivalent to a two-year program, and the A.S. degree can transfer for credit in a four-year program at other institutions. Only union members of participating companies are in classes now, but NACTEL expects to expand to a larger audience. Additional financial support has come from the U.S. Department of Education's Learning Anywhere, Anytime Program, administered by the Fund for the Improvement of Postsecondary Education.

Here's what some students say about NACTEL:

"I am thankful for the opportunity to 'return to school' as I don't have the time to drive somewhere to take classes. I drive 50 miles each way to and from my job and any extra time is very limited. In fact, all of my work has been done on weekends, as that's the only time I have when I am alert enough to study."
—Lois Westfall, Verizon

"Pace is more than just school for me. It's also more than just school work. We have chat sessions and a kind of cyber hangout with each other. It's having friends and relationships. I think I can best describe it as a 'fraternal' following or club. I now have had the pleasure of working with two professors, Dr Barbara Farrell, who I have dubbed 'warrior princess,' and Dr. John Hutton. Both are excellent professors and truly go above and beyond to teach a course. My only sorrow is I did not find Pace sooner. By the way, warrior princess is because Barbara is raising a family, earned her Ph.D. and teaches university level classes. Only a warrior princess can have that much energy."
—Anthony Chiaia, Sr., Verizon

"This affords me the opportunity I turned down years ago." —John Underwood, SBC

Given the success of NACTEL, Sloan and CAEL are now talking with the electric utility industry about developing a similar program. They are also considering online training opportunities with the airlines, auto, construction, and financial services industries.

Verizon's Chiaia continues:

"I love this program. I work with this lady who is attending [another school] and she has this long sad face on all the time. She complains about the course work and on and on … I am not sure what [her school] is doing or NOT doing, but when I talk about Pace at my work to others I have this big smile and a bright glow. Sorry, I cannot help it."

If Anthony Chiaia's response is typical, NACTEL is a model that is likely to bring a lot of smiles to workers.

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2. http://www.cael.org/index2.html
3. http://www.nactel.org

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TURNING STUDENTS INTO VIRTUAL EXPLORERS

© David McLain/Aurora for Classroom Connect

Cheryl Vitali, a fifth grade teacher at Alta Elementary School in Reedley, California, has sent her students off on a quest to solve a mystery: what caused the abandonment of the ancient Anasazi civilization in the American Southwest around 1300? In this project, her class got a little help from some virtual friends a little closer to this question.

Ms. Vitali's students worked online with a classroom of students on a Hopi Indian reservation and with experts and scientists who have long sought answers to this ancient mystery. Interactions like these are made possible by AmericaQuest, part of a unique series of web-based, interactive learning expeditions produced by Classroom Connect as part of The Quest Channel.[1]

During the Quests, a team of historical experts, scientists, and adventurers travel to exotic locations around the world to explore some of the greatest historical, scientific, and natural mysteries of all time. What adds to the unique learning experience of the Quests is that these four to six week explorations are directed by the hundreds of thousands of participating students who read daily reports written by the Quest team, and view video clips sent from the field. They even cast a weekly vote over The Quest Channel Web site about important team decisions, from ethical dilemmas, to where the Quest team should go next in their journey.

Quests are more than just online adventures that use "cool technology." Quests are learning programs, complete with a comprehensive curriculum that meets state and national standards in all core areas, including language arts, math, social studies, and science. Students build skills in:

- **Finding, recognizing, and evaluating content**
  AmericaQuest students were given clues about a "mystery photo" and asked to conduct additional research using the Web and offline resources to develop their answers.

- **Communicating with a broad range of people**
  Students e-mailed historical experts and scientists to learn about their theories of the Anasazi abandonment. Students also used the online Message Board to create discussions with classrooms around the world, exchange ideas, and develop theories to solve the central AmericaQuest mystery.

- **Analyzing information critically, weighing differing perspectives, and coming to one's own conclusions**
  A couple of weeks into AmericaQuest, students were asked to evaluate multiple theories developed from information and evidence gathered and then recommend to the Quest team the theories most worthy of further investigation.

- **Solving open-ended problems by putting together clues to answer questions or generating new ideas based on their research efforts**
  During AmericaQuest students solved ethical dilemmas posed by the Quest team. For example, after discovering an ancient Anasazi burial site, the team asked students if taking photographs of the human remains and posting them on the Quest Web site was appropriate, or whether the team should respect the Hopi (and other Native American) wishes and not photograph them. Students were encouraged to pose their own alternatives and back them up with logical arguments.

- **Developing cultural awareness, getting beyond the surface features of cultures to gain an understanding of how cultures are similar to or different from each other and why**
  Students were asked to draw parallels between modern Hopi traditions and their own family traditions, and then to share their stories on the AmericaQuest Message Board.

"I have often pondered a vision of the ideal learning situation," says Mary Teague Mason, Assistant Principal at Trickum Middle School in Lilburn, Georgia. "In this ultimate experience, students would be actively involved in learning content, skills, and attitudes in an integrated setting. Both the teacher and the students would be working together to solve real problems that genuinely affect the lives of people. Experts would provide the text and real events, the literature. This vision is now available to students all over the world. It is Quest."

The Quests are one example of how web-based content developers are meeting the high expectations of educators like Cheryl Vitali and Mary Mason.

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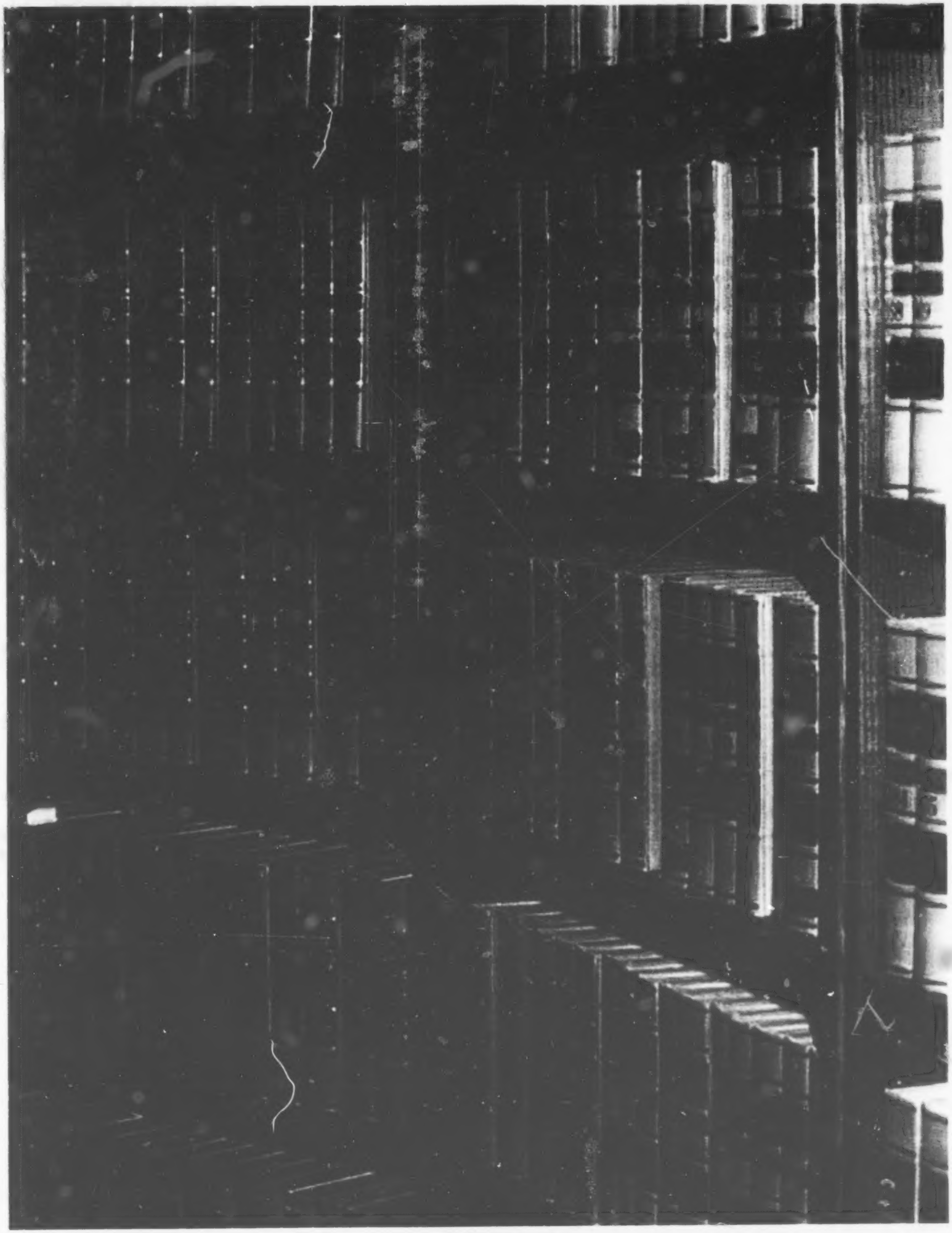


REMOVING REGULATORY RESTRICTIONS TO e-LEARNING

The legacy of the one-room schoolhouse is holding back the potential of the one-world classroom.

The regulations that govern much of education today, from pre-kindergarten to higher education, are focused on supporting the welfare of the educational institution, not the individual learner They were written for an earlier model, the factory model of education in which the teacher is the center of all instruction and all learners must advance at the same rate, despite their varying needs or abilities.

Students in this model are expected to spend 7 years in K-6 schooling, another 6 in secondary schools, 2 years in earning an associate's degree or 4 for a bachelor's. Graduate programs have their own inflexible number of credits, courses, and years at one institution as the required rite of passage.

Funding follows this progression, and is based on the time a student spends in class ("seat time") and the location of that student and that educational program. Estimates for school construction, educational services, and materials are built on these time-fixed and place-based models of yesterday.

These regulations and requirements no longer match today's realities.

High school students can take courses offered online, at their own schedule, and complete them when they pass the appropriate tests. According to some estimates, only 16 percent of today's college students meet the old stereotype of attending full-time, enrolling right after high school, and living on campus.[1] Course content comes not just from a textbook or materials passed out in class by the teacher, but from many sources, in many formats, and even created by the students themselves. Time, institution, and location do not form the defining elements of education.

If not changed, yesterday's regulations will inhibit the potential for new learning opportunities for a new generation of students of all ages.

What is needed, in short, is a wholesale rethinking of the regulatory foundations governing our educational institutions. The Internet cannot be ignored in any such effort of regulatory reform.

Regulation in a Nation of States

In other countries national education ministries set policy. However, our tradition of state and local control of education, particularly in the elementary and secondary arena, presents a special challenge in the Internet era.

Each state establishes its own regulatory structure, and therein lies the challenge. The past physical presence assumed for schooling is no longer a given. Educational content and services at the elementary, secondary, and higher education levels are increasingly delivered across state lines. The regulatory schemes of 56 operational units (states, territories, and Washington, DC) are "dramatically different, ranging from the extremely prescriptive (New York) to minimal (Delaware) and in isolated cases non-existent (Montana)."[2]

preK-12

The PreK-12 Education Regulatory Environment

The nation's pre-kindergarten-grade 12 schools face regulation from the federal and local levels, as well as the states. They are subject to countless administrative procedures implemented in an age that predated the Web; many of these procedures cannot accommodate the Internet's agility. School leaders are increasingly confronted by a desire to innovate but are unable to overcome the timeworn rules that dictate the school day, year, delivery systems, and accounting requirements.

The Commission received testimony on a wide range of specific concerns. Witnesses cited:

Credit policies including the difficulty of transferring and accepting credit across district and state lines and the problem of aligning curriculum standards from one state to another.

Financing policies involving inflexible state budgeting processes, the inability to redirect resources to support distance learning on a per student basis, and less than adequate funding to support the online learning endeavor.

Quality assurance issues that address a need to reform state licensing and approval processes to better access the educational value of content and courses available online.

Attendance policies that set the number of hours and days in the classroom as defining measures of achievement alongside other indicators of academic progress.

Teacher certification policies that prohibit the transfer of credentials from state to state, thereby inhibiting the growth of online delivery of instruction beyond state lines and creating disincentives to develop new online learning models.

Teacher-student ratio requirements that may not take into account the ability of web-based learning to individualize instruction.

Staff compensation requirements that are formulated around 10-month agrarian-model contracts.

Accounting procedures that restrict the use of funding to support web-based instruction based on structural rigidity, rather than academic integrity.

The Postsecondary Education Regulatory Environment

The amount and type of postsecondary regulatory oversight at both the state and federal levels varies depending upon the type of institution: for-profit institutions (often called "proprietary") are the most highly regulated, followed by non-profit institutions ("independent"), and public (state or local) institutions. For the purposes of state law, an out-of-state public institution is generally treated as an independent or, in some cases, a proprietary institution.

Depending upon where they operate and the kind of programs offered, institutions face a variety of regulatory requirements. Independent institutions generally are regulated by regional accrediting agencies while proprietary schools often fall under the purview of other regulatory bodies. For example, proprietary schools in Texas are regulated by the Texas Workforce Commission rather than the Texas Higher Education Coordinating Board.[3] Similarly, proprietary schools in California are regulated by the Department of Consumer Affairs, not the California Department of Education.[4]

While there are strong reasons for this multifaceted control of education, they often do not apply in an environment characterized by borderless educational opportunities.

This challenge was recognized in the 1980s when telecommunications technology meant that broadcast and cable television could be used to deliver "telecourses" across jurisdictional lines. At that time the State Higher Education Executive Officers Association and the Council on Postsecondary Accreditation created Project ALLTEL (Authorization and Licensure of Learning via Telecommunications). The goal was to create a national—but not federal—framework for the regulation of what was that era's distance learning challenge: a proliferation of telecourses of varying levels of quality.[5] The aim was to set up a system in which states would accept the review of the accreditor of the state where the offering institution was located. The effort failed when states could not agree on a common regulatory framework.

POST
SECONDARY

There are unintended and unanticipated consequences of this complex nest of rules and regulations:

- **Some state requirements are mutually exclusive, making it potentially impossible or impractical to create and adjust web-based programs that meet varying state requirements.**

- **A program may be forced to meet the lowest common denominator to achieve homogeneity requirements.**

- **Institutions in one state may refuse to accept credentials awarded by institutions in other states.**

- **Student aid eligibility may be limited for some students involved in technology-mediated learning.**

These issues were raised many times by witnesses testifying at our hearings and through e-Testimony submissions to the Commission. For instance, some states require no approval process for establishing online programs; others require a simple letter explaining their program. Yet another was reported to require an institution to provide an all-expense paid visit to its main location and honoraria to its staff. Fees, reporting requirements, and time required for approval also varied from immediate permission, to a two-year backlog of applications followed by a two-year waiting period.[6]

Beyond these institutional concerns, there are additional barriers for learners. The Internet now makes it possible for a student to purchase a course from his or her local university around the corner, or an institution half a world away. But the same course can be priced very differently. "In-state versus out-of-state tuition rates, non-profit designation, non-profits spinning out for-profits, and for-profit companies create a web of cost structures and tuition regulations that prevent students from choosing the curriculum and price that best meet their needs."[7] This same maze makes it difficult for students to transfer credits from one institution to another and to create the personalized programs that also best meet their needs.

The Internet allows for a learner-centered environment, but our legal and regulatory framework has not adjusted to these changes. "Law is by its nature a slow and deliberative process, and the closer its orbit comes to the development and use of technologies that are changing rapidly, the more likely its impact will be unintended."[8]

Federal Statutory and Regulatory Barriers

The federal government has struggled to establish within statute and regulations a framework that accommodates the promise of the Internet for postsecondary education while promoting access and ensuring accountability.

The effort has had mixed results.

Three specific federal issues were brought to the Commission's attention: the "12-hour rule," the "50 percent rule," and the federal prohibition on providing incentive compensation in college admissions.

The 12-hour Rule

When Congress amended the Higher Education Act in 1992, it added a specific definition of an academic year that prescribed at least 30 weeks of instructional time. Full-time undergraduate students in traditional academic programs are expected to complete at least 24 semester hours or trimester hours (or 36 quarter hours, or 900 clock hours) in that time period to be eligible for the maximum amount of financial aid under the Title IV program.

However, the law was silent on establishing an academic workload requirement for students enrolled in Title IV eligible programs offered in a nontraditional time segment.

To deal with this, the U.S. Department of Education developed regulations to implement the statutory definition of an academic year, including establishing full-time workload requirements for students enrolled in programs offered in nontraditional time segments. In 1994, the Department issued formal regulations defining a week of instructional time to mean 12 hours of "regularly scheduled instruction, examinations, or preparation for examination" for programs that are not offered in standard terms.

The 50 Percent Rule

Likewise, the "50 percent rule" requires Title IV-eligible institutions to offer at least 50 percent of their instruction in a classroom-based environment. The basis of this rule is to assure that a student is physically participating in an academic course of study for which he or she is receiving federal student financial assistance. In enacting this provision in the 1992 Higher Education Amendments, Congress sought to address concerns about fraud and abuse within the correspondence school industry.

While understanding that physical seat time may not be an appropriate measure of quality for the increasing proliferation of online distance learning programs, the Department views these two rules as important measures of accountability that should not be eliminated or replaced unless there is a viable alternative.

In recent months, public, independent, and proprietary colleges and universities have called for the elimination of the 12-hour rule and the 50 percent rule or, at minimum, a moratorium on their enforcement.

These institutions argue that the rules simply don't make sense in light of online distance education and the growing use of the Internet for instructional delivery. As one witness put it: "If we are to be required to assess educational quality and learning by virtue of how long a student sits in a seat, we have focused on the wrong end of the student."[1]

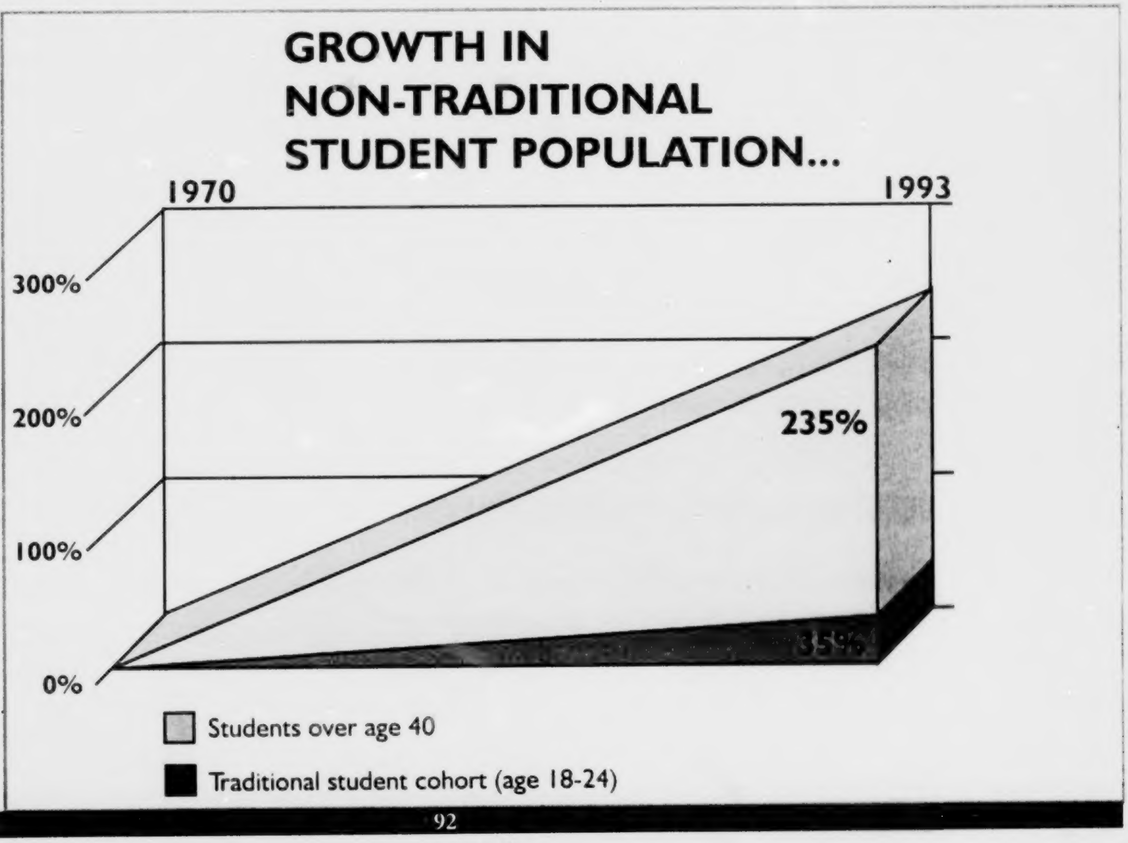
> "If we are to be required to assess educational quality and learning by virtue of how long a student sits in a seat, we have focused on the wrong end of the student."
>
> (Laura Palmer Noone, testimony before the Web-based Education Commission, July 19, 2000)

Far from creating incentives for students and institutions to experiment with new distance education methodologies offered anytime, anyplace, and at any pace, the current student financial aid regulations discourage innovation. If a student cannot travel to an institution and participate in face-to-face instruction, that student may only qualify for reduced financial aid. The practical impact is a system of federal student financial assistance that gives substantial preference to the mainstream educational experience.[10]

In seeking correctly to halt abuse in the student financial aid program, these rules may, in fact, have the unintended effect of curtailing educational opportunity among thousands who seek financial aid for college, but who do not otherwise fit into the mainstream definition of a college student. Consider these statistics:

- **The span from 1970 to 1993 saw a 235 percent growth in students over age 40.**
- **Over the same time period, the traditional college student cohort (age 18-24) increased by 35 percent.**
- **Forty percent of these students received financial aid, as opposed to only 17 percent of undergraduates over the age of 40.[11]**

The U.S. Department of Education is beginning to identify potential alternatives to providing student aid to those enrolled in online programs. In October 2000, it convened dozens of representatives of traditional and nontraditional postsecondary institutions, higher education associations, and the student financial aid sector to address alternatives to the 12-hour rule. The Department's position has been that a wholesale elimination of these rules would leave the door wide open for abuse—and the history of the Title IV program has been marked


GROWTH IN NON-TRADITIONAL STUDENT POPULATION...

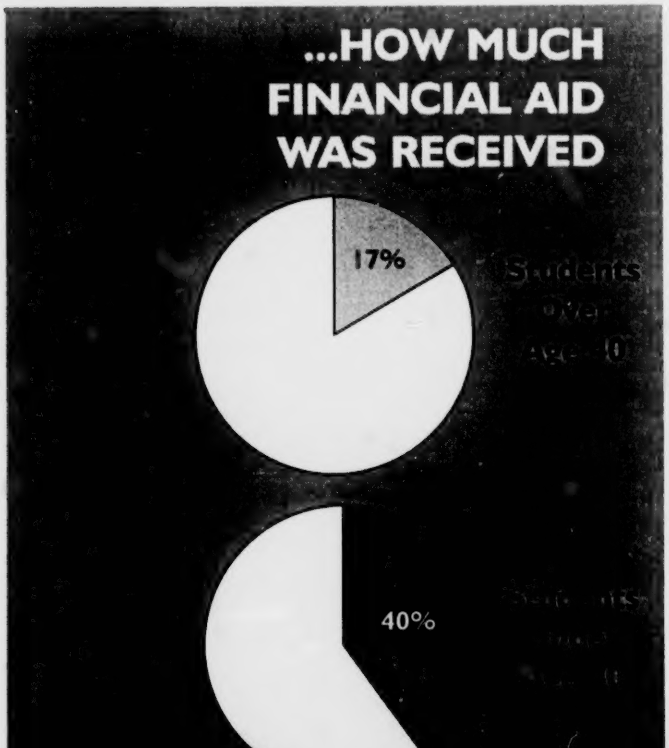
with such episodes. Instead, the Department is seeking to identify alternatives to current regulation, and assess whether or not they may be more appropriate than current seat-time measures. The Department holds strongly to the belief, however, that rules of some kind are necessary under any circumstance.

Institutions take a different position. Many question the need for the Department to be involved on the regulatory side at all since these institutions already are subject to two sets of quality controls: approval for participation in the Title IV program and accreditation and licensure. They argue that if the problem is with accrediting agencies that are not organized to assess quality effectively in an online learning setting, the answer is to reform the accreditation process, not add another enforcement layer upon postsecondary institutions.

The University of Phoenix, among the nation's oldest distance learning proprietary institutions, offered the following recommendations in support of this view:[12]

- **Rely on the accrediting bodies to make determinations about the quality of online distance learning programs** and encourage that they hold such programs and providers to the same set of standards that are expected of face-to-face instruction. No less should be expected from these programs, but indeed no more should be expected. If there are flaws in the system of accreditation, then the Department should be directed to review those entities, rather than duplicate the efforts of accreditation.

- **Re-evaluate the criteria for accreditation.** By statute, accrediting bodies are required to evaluate certain elements of an institution in making accreditation decisions. Most of these factors are input-based and have little demonstrated relationship to student learning. Accrediting bodies should be required to focus on outcomes and it is only in this way that any meaningful evaluation of web-based education can be made.



The Department is hosting several working groups with the higher education community to focus on student aid funding for online programs, alternative input and output measures of online quality, and the role of accreditation in assuring academic integrity in the Title IV program. A result could be a statement of the problem and potential alternatives to be considered by Congress and/or Department regulators.

Additionally, the Department will analyze the results of the Distance Education Demonstration Program authorized by the Higher Education Act Amendments of 1998. This program exempts 15 institutions and consortia of institutions from the different rules and regulations limiting student financial aid for online postsecondary learners. The goal is to encourage distance education providers to experiment with alternative measurements of online quality and gather data on the success of these alternatives. The results will be presented to Congress along with any proposed changes the Department recommends in this area.

Ban on Incentive Compensation Plans

In 1992, Congress prohibited colleges and universities that participate in the federal student financial aid program from paying any commission, bonus, or other incentive payments to third party entities based directly or indirectly on their success in helping to secure enrollment of students.

The provision was enacted to protect students against abusive recruiting tactics, although the law is now being interpreted to apply to the enrollment of students via "Web portals." These online "Yellow Pages" are commonly financed through the use of referral fees and tuition-sharing agreements. Although not the original intent, the language of this restriction effectively bars higher education institutions that participate in Title IV from using third-party Web portals to provide prospective students with access to information about many institutions or provide the same services as institutions offer on their own Web sites—that is, information and application processing.

Current federal regulations permit an institution to use its own Web site to recruit students. However, if the institution pays a Web portal to provide the same passive, asynchronous service, and that payment is based on the number of prospective students visiting the site who ultimately apply or enroll, the institution is at risk of losing its Title IV eligibility. Higher education groups have asked the Department to consider changing regulatory language, reflecting the growing reliance of higher education consumers on Web portals. However, the Department has concluded that this provision could only be changed through new legislation.

Copyright Protection: Horse and Buggies on the Information Superhighway

"The primary objective of copyright is not to reward the labour of authors, but [t]o promote the Progress of Science and useful Arts. To this end, copyright assures authors the right to their original expression, but encourages others to build freely upon the ideas and information conveyed by a work. This result is neither unfair nor unfortunate. It is the means by which copyright advances the progress of science and art."[1]

"In a digital age, the organization of data and editorial function of summarizing, hyperlinking, and relating diverse sources of data to meet specific ad hoc needs adds value to content, and represents an emerging class of intellectual capital that goes beyond the concept of 'derivative works' or similar earlier classifications . . . The Internet turns 'consumption' of electronic media into a Breeder Reactor scenario for knowledge building. Effective use of these materials results in additional fuel to power learning in the classroom."[4]

Copyright law serves to balance the legitimate intellectual property rights of authors, publishers, and other copyright owners with society's right to the free exchange of ideas. The Copyright Act of 1976 established principles that make it possible for researchers, students, and members of the public to benefit from access to published information. That access is supported by the concept of "fair use," the provision to reproduce materials under certain circumstances.

In the Digital Millennium Copyright Act of 1998, Congress requested the U.S. Copyright Office of the Library of Congress to study the impact that copyright laws might have on online education. It recognized that changes in copyright law might be necessary to ensure that fair use of information is equally available to students and researchers in the digital as well as physical realm.

Congress specifically directed that the law be reviewed "with an eye toward promoting distance education."[15] With input from publishers, higher education, libraries, and other users and producers, the Copyright Office presented its report, "Copyright and Digital Distance Education,"[16] to Congress in May 1999. The recommendations include clarifying the meaning of transmission to include digital as well as analog and eliminating the requirement of a physical classroom. Hearings were held on this report, but no legislative action has been taken.

Copyright remains a major concern to educators, researchers, and librarians as well as publishers, developers, and copyright holders. Current copyright law governing distance education is over 20 years old and was based on broadcast models of telecourses for distance education. That law was not established with the virtual classroom in mind, nor does it resolve emerging issues of multimedia online, or provide a framework for permitting digital transmissions.[17]

> "The primary objective of copyright is not to reward the labour of authors, but [t]o promote the Progress of Science and useful Arts."
> (Sandra Day O'Connor, U.S. Supreme Court Justice)

Educators and library representatives maintain that the current pay-per-view business model used in education bypasses, and thereby negates, explicit provisions in the copyright law intended to protect and encourage educational use of copyrighted material.[18] They maintain that for web-based education to achieve its potential, students should be able to access remotely all educational material available to students in a physical classroom, and be able to do so from any location at any time (e.g., from a college student's dorm room computer on the weekend or from the home of a working adult in the evening).

Educational institutions seek the ability to use copyrighted works in a digital environment comparable to what the law currently allows in a face-to-face classroom.

This current state of affairs is confusing and frustrating for educators. Many educational institutions report having difficulty with licensing for digital distance education. Professors complain about being forced to obtain licenses to use the same works in an online course that they are allowed to use under fair use provisions in a face-to-face classroom.

After teachers complete the task of determining who the copyright owner is, they often face delays in locating the owner, obtaining permission, and possibly incurring costs.

The gap between the technology of distance learning and the language of the current copyright statute threatens the element of spontaneity from online instruction that the current statute affords in the analog world. It may cause online course developers to compromise their content, and has deterred some educators from entering the world of distance education altogether.

These following examples were offered by the e-Testimony of the American Association of Community Colleges:[19]

- **A music instructor at Lake Land College in Mattoon, Illinois has the ability to play songs and other pieces of music in her classroom, but is faced with the prospect of drafting numerous letters seeking permission from copyright holders in order to incorporate these works into an online version of the same class.**

- **At Northwest Michigan College in Traverse City, Michigan, a children's literature instructor routinely displays many illustrations from children's books in her traditional class, but when considering an online version of the course must spend precious time and resources obtaining licenses for each of these works, or leave illustrations out of altogether.**

- **Current fair use exemptions allow a professor who comes across a work in the morning that perfectly illustrates a point to be made in that afternoon's lecture to use it for a traditional class. The same professor must wait until permission is granted to use it in an online version of the class.**

The confusion on digital copyright use can be especially frustrating for K-12 educators who want to demonstrate appropriate copyright use with their students but are limited in the time and resources they can devote to acquiring rights to materials. Concern about inadvertent copyright infringement appears, in many school districts, to limit the effective use of the Internet as an educational tool. Schools are in a position of potential liability if a teacher or student fails to understand or appropriately apply copyright law and posts material on a school Web site. "The only way a school can fully protect against financial liability is to take a totally hands-off role with respect to the Web pages it posts on a school site, which no school should do."[20]

Proposals to amend the Copyright Act and update fair use provisions are opposed by publishers. They correctly point out that the risks of unauthorized dissemination of copyrighted works are greater in an online environment than in a physical classroom, and maintain that technological safeguards are not yet widely available to prevent unauthorized uses. Without adequate safeguards the artists, writers, designers, programmers, and educators who create new works for instruction may not be appropriately compensated for their creativity.

"Providers may occasionally have problems with copyright…[but] these…are the by-product of marketplace 'growing pains'…There is ample time and reason to let the flexibility of the marketplace… work out continuing copyright issues… without government mandates."

(Patricia Schroeder, Association of American Publishers, testimony to the Web-based Education Commission, July 19, 2000)

One representative of the publishing community stated it this way:

> *"If [publishers] are not adequately compensated, our society will suffer from their withdrawing their work for the public sector, a loss to society as a whole and education in particular…Since no one is advocating that Congress should enact legislation eliminating the need to pay for computers, software, Internet access, faculty salaries, cost of administrative personnel and processes and tuition in connection with online education programs, why should the costs of course materials—and, therefore, the copyright owners who create and produce them—stand alone as exempt from payment of fair market value in a competitive marketplace?"*[vi]

The publishing industry is also concerned that the confusing landscape and consolidation of non-profits and for-profit providers of educational content make policy based on public versus private good difficult, if not impossible, to define.

Rethinking Regulation

We are entering the 21st Century with antiquated regulations of educational policy and inappropriately restrictive copyright laws. It is as if we tried to manage the interstate highway system with the rules of the horse and buggy era. Although the federal government has a legitimate role in monitoring how its funds are used and in protecting intellectual property, it is clear that a radical rethinking of the relevant body of regulation and law is in order. Otherwise the Internet will remain more a province of auctions and games, than a place for genuine learning.

LEARNING AT 'VIRTUAL U'

The virtual university is a reality. Unique in design but traditional in focus, virtual universities offer learners the opportunity to move beyond the barriers of physical space and time by taking courses online.

The potential of the virtual university is seen in the offerings of companies like UNext.[1] Founded in late 1997, UNext is committed to developing and delivering high-quality higher education to learners around the globe.

It is this idea that led the company to launch Cardean University, an online university that delivers postsecondary business, executive, and professional education, and is authorized to offer a Master's degree in Business Administration.

UNext and Cardean University have established a consortium of elite academic institutions including Columbia University, Stanford University, the University of Chicago, Carnegie Mellon University, and the London School of Economics and Political Science. UNext is collaborating with faculty members from these institutions as well as other leading scholars and experts to produce a unique, state-of-the-art educational experience on the Internet.

UNext focuses on "enhanced learning"—a learning platform that combines the advantages of a traditional university setting, such as community and collaboration, with the flexibility and responsiveness of online learning. Its approach is driven by one core idea: that the Internet fosters real learning because it facilitates collaborative and productive "learning by doing" activities. In this way, students, who may otherwise be unable to return for a graduate degree or who need continuing education, may enhance their skills and knowledge, and receive a chance at extending their learning prospects.

The Concord University School of Law[2] provides another online model, one focusing on legal education. Because of work and family obligations, financial or geographic constraints, or even physical disability, many who want to become attorneys find that their goal is elusive.

Founded in 1998 by Kaplan, Inc., Concord University School of Law provides legal education to people unable to attend a fixed facility program. On average, the Concord student is 40 years old. Nearly a third of students enrolled hold advanced degrees. Many Concord students live in communities where there is little or no access to a law school. Others have a law school in the area, but still choose Concord for the flexibility and convenience of its wholly online delivery.

Concord's curriculum, casebooks, and textbooks are the same as those found at law school campuses nationwide. Students access the curriculum through their "Personal Homepage," which provides an interactive syllabus for each course. Lectures are viewed on the Internet with students logging on at their convenience 24 hours a day, 7 days a week.

Although Concord's virtual law school is only in its third year, the early reports show good results. The initial 2 groups of Concord students sitting for the First Year Law Student Examination in California had first-time pass rates ranging from 20 percent to 33 percent higher than the state average. They scored 80 percent higher than students from other American Bar Association-approved programs who have been required to take the exam during the last five years.

A third approach is OnlineLearning.net,[3] one of the largest virtual universities in the U.S. OnlineLearning.net selects prominent university partners and then helps them produce and market their fully accredited courses and programs to working professionals. The classes are small in size, interactive, instructor-led, and highly collaborative. In addition, it provides students with an "online concierge" in every course, and has a unique online faculty and instructor development program. More than 90 percent of the students enrolled in courses complete them, with 85 percent rating the courses "as good or better than face-to-face learning."

The University of Phoenix Online program[4] was started in 1989 and has been providing complete degree programs for working adult students for over a decade. With 1,200 faculty members, it currently offers 10 accredited degree programs in business, education, information technology, and nursing. Currently over 15,000 students attend class via the online program. While the University's enrollments have grown at over 22 percent per year, the Online campus has routinely grown at over 50 percent per year. The popularity of this program is proof that there is a demand for alternative delivery modes in higher education.

Virtual universities are helping learners connect with a new world of educational opportunities. Through these and similar programs students around the world are accessing the best educational resources—anytime, anywhere, at any stage in life.

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2. http://www.concordlawschool.com/
3. http://www.onlinelearning.net/
4. http://www.phoenix.edu/

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BEST COPY AVAILABLE

PRIVACY, PROTECTION AND "SAFE STREETS"

The Internet carries with it danger as well as promise. Advertising can interfere with the learning process and take advantage of a captive audience of learners—of all types and ages. Privacy can be endangered when data is collected on users of online materials. Students, especially young children, need protections from harmful or inappropriate intrusions in their learning environments.

We all have a responsibility to assure that they do not find themselves in the "dark places" of the World Wide Web.

> "You'll look up and
> down streets. Look
> 'em over with care.
>
> About some you will
> say, 'I don't choose to
> go there.'
>
> With your head full of
> brains and your shoes
> full of feet,
>
> You're too smart to go
> down any not-so-good
> streets."[1]
>
> (From OH, the Places You'll Go! by Dr. Seuss. TM & copyright © by Dr. Seuss Enterprises, L.P. 1990.)

Online Advertising and Marketing in Schools

While many consider materials on the Web to be free, "banner ads" and other forms of online advertising support much of the material. Some maintain that schools should consider this as a non-intrusive tradeoff for high quality online content. They argue that commercialism is a part of society, has been a part of the school environment for years, and that students largely ignore product advertisements.[2]

Yet, where some see corporate support, others see exploitation.

Critics decry the extension of advertisers into the school, and their added power in the online environment. They counter that, if students are expected to ignore ads, then why are companies spending millions to "capture the eyeballs" of the youth market? Advertisers are aware that children spend or influence $500 billion worth of purchases. Children, not their parents, are increasingly the focal point for advertising.[4]

> "We look for education to become the 'stealth' portal to over 65 million students and their 50 million parents."
>
> (Thomas Weisel Partners, in ".com Meets .edu.")[3]

Some companies have gone further by providing whole systems to schools, including computer labs, online access, and software, in return for advertising that appears when the Internet is accessed from these facilities. The ZapMe Netspace was one such effort. It offered a 2 x 4 inch banner ad window that presented multimedia ads to students at all times, with the ads changing every 15 seconds, exposing students to approximately 200 ads in a 50-minute class period.[5]

Some schools and districts have gone the opposite direction, banning advertising altogether. In 1998, the National Association of State Boards of Education developed a set of principles to guide state boards in the development of policy regarding corporate involvement in schools.[6] Among the principles for "positive school-business relationships" were the following:

- Corporate involvement shall not require students to observe, listen to, or read commercial advertising.
- Selling or providing access to a captive audience in the classroom for commercial purposes is exploitation and a violation of public trust.

Online Profiling

Online profiling is the collection of information from and about an individual as he or she uses the Internet. This can be accomplished either through the collection of personal data a user provides or through the use of screen name or identifier "cookies" placed on a hard drive by the Web site or third-party delivering ads to a Web site.[7]

Many consumers are unaware when they are being profiled or that profiling is in fact a sophisticated form of personalized marketing. A recent BusinessWeek/Harris Poll found that only 40 percent of those surveyed had even heard of cookies, and only 75 percent of those who had knew what they were.[8]

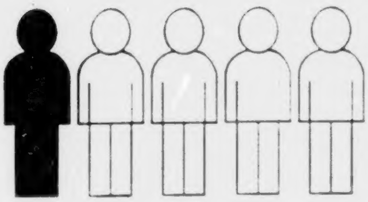
This lack of understanding is a special concern for students and young children, unsophisticated as they are in the importance of protecting information privacy. Children, and even teenagers (currently not covered by the Children's Online Privacy Protection Act—COPPA), may not have yet developed the sophisticated skills to understand why they should not provide information to others online.

A recent study by the Annenberg Public Policy Center found that, although young people expressed concerns about protecting privacy and information that may be collected about them on Web sites, when offered a free gift in exchange for personal or family information, many more children than parents were willing to provide this information.[9]

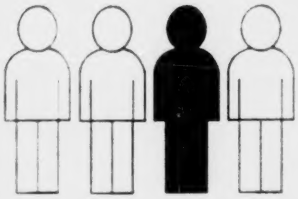
Young People and the "Dark Streets"

A more direct threat is children's exposure to violence, pornography, and predators on the Web. A recent study entitled Online Victimization: A Report on the Nation's Youth,[10] conducted interviews with a nationally representative sample of 1,500 youths ages 10-17 who use the Internet. The study found that large numbers of youths are encountering offensive experiences on the Internet. Twenty percent were sexually solicited. Six percent were harassed. The offenses and offenders are diverse, not just men trolling for sex. Much of the offending behavior comes from other youth, and some from women. Teenagers are the primary targets, creating a different sort of challenge than would be the case if younger children, over whom parents have more control, were the primary targets. Although most solicitations fail, the sheer numbers are alarming. Several million young people, ages 10 to 17, are sexually propositioned on the Internet every year.

NUMBERS OF YOUTHS ENCOUNTERING OFFENSIVE EXPERIENCES ON THE INTERNET



One in five were sexually solicited



One in four were exposed to unwanted sexual material

Furthermore, sexual material is intrusive on the Internet. One in 4 youths surveyed had an unwanted exposure to pictures that included nudity or even more graphic sexual scenes. Although all these offenses are troubling, most youths do not tell parents, teachers, or even their friends about them. Even when parents are aware of the offenses, they, like their children, do not know where to report them.

The authors of the study emphasize that Internet friendships between teens and adults are not uncommon and are generally benign. In fact, the opportunity for people of all ages to congregate and chat online about common interests is one of the great strengths of the Internet, and one of the reasons it can be so useful for young people as they reach out to individuals who can be positive role models and mentors. The authors also state: "We need to learn more about the signs and symptoms of potentially exploitative adult-youth relationships, not just on the Internet, but in face-to-face relationships too."[11]

The study makes another important point: that the Internet is far from the only, or the greatest, threat to young people in our society.

Among respondents in the study, 30 percent had been attacked in real life by other youths in the last year. Other studies on school violence make it clear that child victimization in the online world is dwarfed by what they experience in the real world. Wherever such threats occur, society must work to address the many "not so nice streets" that can lead to the victimization of America's youth.

Potential Solutions

Protection comes in many forms and levels of control ranging from legislation to voluntary acceptable-use policies, to technical solutions like filters, monitoring systems, and portals, to consumer empowerment systems like ratings and consumer and learner education. No one "solution" is perfect—each has benefits, each has limitations. Their potential utility depends on personal and community preferences as well as the setting (home, preK-12 education provider, library, higher education, or training environment).

Legislation has been one response. The Children's Online Privacy Protection Act (COPPA) went into effect April 2000. It regulates the collection of personal information from children under the age of 13. It requires commercial Web sites targeted at children under 13 to secure parental permission before collecting, using, or disclosing personal information from children. These sites must also post a privacy policy detailing what personal information is being collected, how it is to be used, and if it will be given to third parties. While most witnesses who testified before the Commission support the underlying intent of COPPA, several concerns were raised:

- **COPPA does not cover teens, an especially vulnerable group for online victimization as noted above. Teens are also major targets for online profiling and marketing.[12]**
- **Current "opt-in" requirements for "verifiable parental consent" may unduly restrict children's access to valuable online educational resources in schools. One witness expressed the concern that if "a single child fails to obtain parental consent, this could compromise or preclude an entire class from using an online learning program."[13]**
- **COPPA's administrative and record-keeping burdens for schools are substantial and may be enough to discourage full usage of the Internet. The National School Boards Association and American Association of School Administrators predict "the drastic increase of schools' administrative**

responsibilities prior to engaging their students in online activity would have a 'chilling' effect on the positive, productive collaborations of educational businesses and schools."[14]

- **Of equal concern is the dampening effect COPPA requirements could have on innovative uses of the Internet for delivering personalized content and assessment materials. The regular collection of student data is necessary for these systems to function.[15] One proposal suggested throughout the Commission's hearings would allow parents of young children to "opt-out" of their child's participation in an online activity or service.**

Filtering or blocking software (also known as "firewalls") is an approach advocated by many. Legislation has been proposed that would prevent schools from receiving E-rate funding for discounted Internet use unless they filter Web content. Witnesses voiced concern with this approach for both practical and philosophical reasons. On the practical side, filters are not foolproof. Often unwanted material gets through.

Other times valid content may be screened out inappropriately (e.g., students doing research on breast cancer found that their filter does not accept sites containing the word "breast"). Filters can create a false sense of security, and have been called ill-advised solutions since Internet sites can appear, shift, and relocate overnight.[16]

One-third of the families surveyed in the online victimization study report that they currently use filters. However, 5 percent say they have stopped using them, suggesting some level of dissatisfaction.[17]

There is also the philosophical concern about filters in public institutions like libraries, raising freedom of information issues.

One witness suggested that purveyors of objectionable material could be required to check a database of those who opt out of receiving this material (like those who opt out of receiving telephone or mail advertising or other solicitations). Those who receive objectionable material online against their stated wishes could then have legal recourse.[18]

Monitoring systems are software solutions that provide a record of the sites a person has visited on the Internet. Most browsers keep at least a short-term record, and more complex monitoring systems can collect past visits by viewer. This is a relatively simple, low-cost solution for parents and schools, who can link accountability with education efforts and attach consequences for inappropriate or unauthorized activity.

Approximately three-fifths of households surveyed in the online victimization study reported that parents or guardians checked the computer history function to see where their children had been travelling on the Internet. Obviously, monitoring systems are only as good as the amount of attention they are given by those supervising students' Internet use.

Ratings systems put the power of choice back on the user, school, parent, or other authority figure supervising students' use of the Internet. Like ratings for movies, television, software, and now video games and music, the rationale is to give the consumer a choice. The Internet Content Rating Association (ICRA) is an independent, nonprofit organization that promotes

PROTECTING THE STUDENT ON THE INTERNET

APPROACH TO PROTECTING STUDENTS	DESCRIPTION	ADVANTAGES
Filters, Firewalls, and Blocking Software	Although they differ in form, all filters allow access to a restricted collection of Web sites. Access may be either provided to approved sites or blocked to sites that are considered off-limits.	• Ease of use. • Automatically block material that has been identified as unacceptable. • Many allow authorized users to override default lists or add approved sites.
Ratings Systems	Recreational Software Advisory Council on the Internet, managed by the Internet Content Rating Association, provides consumers information about the level of sex, nudity, violence, and offensive language in Web sites.	• Provides useful information for parents and schools.
Monitoring Systems	Monitoring systems keep a record of which sites have been accessed, how much time is spent on them, and to whom e-mail messages have been sent.	• Schools and parents can respond if students are spending too much time off-task or accessing inappropriate sites.
Time-monitoring Systems	Limits the amount of time students are online, or the specific times of day it is possible to go online.	• More appropriate for home use.
Kid Search Engines	Search engines designed to locate only information approved for children.	• Can provide commercial free zones. • Often includes filters and blocking systems.
Portals/ Greenspaces	Closed collections of Web sites that have been pre-selected. This approach is analogous to a playpen where the occupant can play with anything inside, but not access anything outside.	• Security to let students explore the approved space. • Content quality control for educational purposes.
Acceptable Use and Privacy Statements	Contracts signed by students and parents setting guidelines for use of the Internet. Schools, libraries, and community centers often create their own policies based on their local contexts.	• A local solution.
Education of Students, Parents, Teachers, Administrators	Courses and informal training in how to be a responsible, safe "Netcitizen"	• Long-term empowerment. • Necessary to impact out-of-school online access. • Opportunity to provide important moral and character-building lessons on respect, nondiscrimination, social and academic responsibility.

(NOTE: MANY OF THE FOLLOWING ITEMS ARE USED IN TANDEM, OR OVERLAP EACH OTHER. THERE IS A DISTINCTION BETWEEN PROTECTING STUDENTS FROM INAPPROPRIATE CONTENT AND PROTECTING STUDENTS FROM PRIVACY VIOLATIONS. THIS CHART ADDRESSES INAPPROPRIATE CONTENT, ALTHOUGH SOME SOLUTIONS ADDRESS BOTH ISSUES)

DISADVANTAGES	EXAMPLES
• False sense of security. • May exclude valid sites with critical information. • Restricts freedom of speech • Server-based filters are not easily, if at all, modifiable. • Lack of clarity regarding criteria for filtered sites.	CYBERsitter http://www.cybersitter.com ZeekSafe http://www.zeeks.com SMARTPARENT.COM http://www.smartparent.com
• Many parents found to ignore ratings. • Not well developed. • Sites are self-rated. • Perceived infringement on free-speech rights. • Few incentives for sites to rate themselves.	Internet Content Rating Association http://www.icra.org
• Concerns with violation of privacy rights.	Internet Watch Dog http://www.charlesriver.com/WD.html/ FamilyCAM www.silverstone.net
• Only addresses one aspect of issue.	ConnectLink http://www.cloh.net Smart Guardian for Public Libraries and Schools http://www.smartguardian.com
• Similar problems as with filters above. • No local control/override option.	Yahooligans http://www.yahooligans.com Ask Jeeves http://www.askjeeves.com
• May block access to necessary sites. • Criteria for site inclusion determined by portal creators.	ALFY: The Web Portal for Kids http://www.lightspan.com Blue Web'n http://www.kn.pacbell.com/wired/bluewebn
• Difficult to enforce and monitor.	Nancy Willard, Information Technology Consultant Eugene, Oregon http://ion.erehwon.com/k12aup/ Hazleton Area School District in Pennsylvania http://hinet1.hasd.k12.pa.us/aup.shtml
• Unwanted exposure to "dark places" may still occur.	Bertelsmann Foundation http://www.bertelsmann-stiftung.de/english/projekte/bereiche/index.htm Media Workshop NY http://www.mediaworkshop.org The Children's Partnership http://www.childrenspartnership.org Internet Education Foundation http://www.getnetwise.org

a voluntary content-based ratings system built around Web operators' responses to questions about violence, nudity, sex, and offensive language.[19]

The value of ICRA ratings has been debated, especially as the self-assessment aspect of the system may not correspond with judgments a parent or teacher might make regarding the level of intensity of questionable content. Furthermore, as Web sites change rapidly, keeping a rating system up to date is nearly impossible.

Portals offer a gateway to pre-selected, screened sites around a particular area of interest. They often combine the features of a firewall and a ratings system by assuring that offensive materials or those inappropriate for children will not be included. Portals provide a way for parents and educators to guide students not only to sites that have been deemed of value, but also to those that do not present negative online experiences.

Acceptable use policies and education are solutions supported by all witnesses before the Commission. Educators, parents, and those who work with young people need to be aware of the dangers the Internet can pose to the privacy and safety of all users. Families need to know about various strategies and tools they can use to guide and protect themselves. Communities—including schools and libraries—must develop standards for what they consider appropriate monitoring of Internet usage for various age groups. These communities of users, from community to classroom to family, must develop and abide by acceptable use policies they feel comfortable with, along with appropriate sanctions for irresponsible behavior. Educators and parents must teach young people what it means to be safe and responsible online citizens.[20]

Learning that there are dark streets on the Web and in real life is a necessary lesson in the education of today's modern student. Regrettable as is it may be, this lesson is an integral part of becoming a learner in today's society.

"YO, IT'S TIME FOR BRACES"

Neme Alperstein, a fifth grade teacher at Harry Eichler School in Richmond Hill, Queens, has a gift for teaching on the Web like Garrison Keeler has a gift for story telling. She is a master. She already had her fifth graders going online for Stock Market Games and corresponding with NASA sites when a friend told her that ThinkQuest,[1] an international organization encouraging student learning through technology, had opened a junior competition.

Alperstein immediately went online to check out this rumor and discovered that there was exactly half an hour left to register and file for the 1999 junior competition. Knowing what this could mean for her students, and what they could do, she filed. The race was on.

Harry Eichler (Public School 56 in New York City) is a school long on challenges (it must educate students from more than 35 countries) and short on resources (it has no library, only a rolling cart of books).

Part of the compelling draw of ThinkQuest for students and teachers alike is that kids form their own teams for the competition, and can choose any topic they wish as the basis for participating. Motivation comes from pursuing what truly interests them. Fifth grade student Madeline Gesslein wanted to lead a team. She was about to get orthodontic braces and thought others kids would like to know about this daunting procedure. Alperstein's son was also about to have oral surgery, and she realized the kids could learn about medicine and health on the project. These opportunities and interests gave birth to, "Yo, It's Time for Braces,"[2] a ThinkQuest Junior platinum winner in the sports and health category for 1999, and a finalist (with the Mayo Clinic) for the Global International Infrastructure (GII) Award.

The Web site is now a worldwide resource for children who must get braces, one that greets children with this opening banner:

"Warning: This site contains a great many teeth."

The site offers three major pages: Deciding to Get Braces, What Happens at the Orthodontist's Office, and Living with Braces. The students interviewed an oral surgeon and surveyed fourteen orthodontists. Madeline, the team captain, chose her friends Svetlana and Val as her principal colleagues. Alperstein encouraged students with different kinds of skills to participate. Svetlana translated five of these surveys, as well as a "Picture Glossary" into Russian.

On the site there is a cartoon drawn by the team members called "Sandy Gets Braces." Madeline's Journal, about her experiences with braces, includes original artwork. There is a page about celebrities who had braces. Visitors are encouraged to write about their own experiences in the guest book. "We think that if kids know more about braces, then they won't be afraid of them," say Madeline and her friends.

Because the site is carried on the ThinkQuest server, kids from around the world continue to click in to learn about braces and leave letters sharing their own experiences in the guest book.

But the story doesn't end there. After Alperstein's class won its ThinkQuest award, the students had another idea. One student had bought a Pokemon card that turned out to be a fake. The class decided it was important to learn more about copyright issues. Students worked with webmasters at several government agencies, including the Patent and Trademark Office's special Kid's Page, the staff at the National Digital Library, and the Art Museum Image Consortium. They launched "Art Rights,"[3] their newest Web site containing among the most sophisticated information available on copyright and the Internet—written by and for kids.

"These are 10-year-olds," Neme Alperstein says. "They do things I don't know how to do—my main directive is 'make it work.' They work intuitively; they find a way. We are not into failure." She also observes that "The kids have no fear, they don't know that 10-year-old kids don't usually get responses from adults."

Despite the challenges of their educational surroundings, these kids—and their teacher—are real winners.

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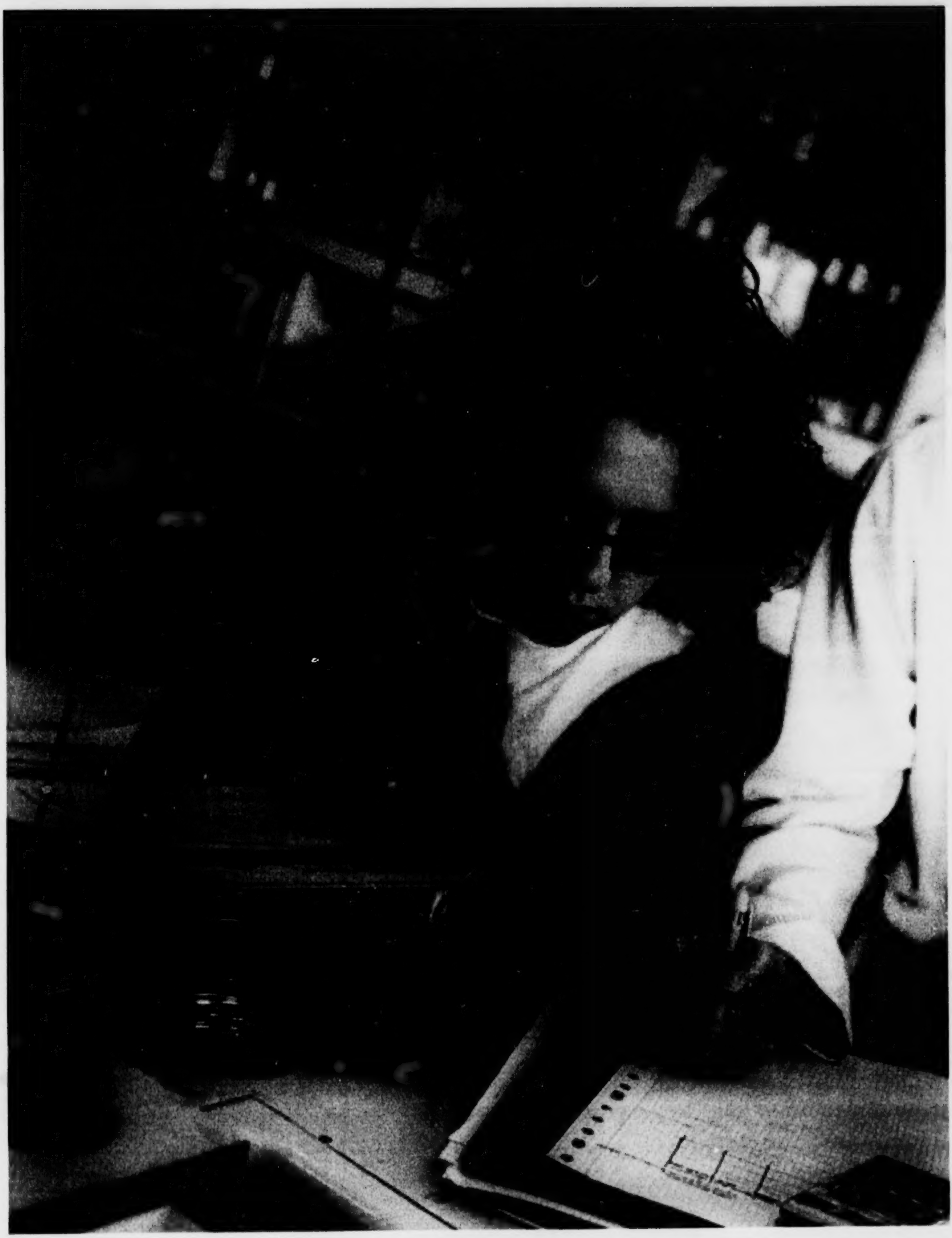
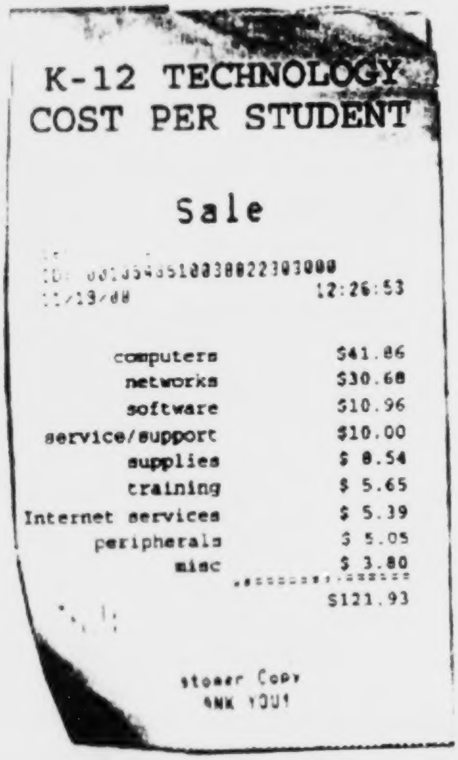


FUNDING FOR e-LEARNING: A CONTINUING CHALLENGE

Technology is expensive, and web-based learning is no exception. Technology expenditures do not end with the wiring of a school or campus, the purchase of computers, or the establishment of a local area network.

They represent just the beginning.

We must therefore respond to these realities by addressing head-on how best to finance technology-based, student-centered learning environments that will enable success in the digital era.



K-12 TECHNOLOGY
COST PER STUDENT

Sale

ID: [illegible]
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computers	$41.86
networks	$30.68
software	$10.96
service/support	$10.00
supplies	$ 8.54
training	$ 5.65
Internet services	$ 5.39
peripherals	$ 5.05
misc	$ 3.80
	$121.93

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ANK YOU!

Total Cost of Ownership

In some ways, school Internet capital expenses are equivalent to the expenditures a district makes in purchasing a fleet of school buses. After the initial cost of the purchase, the school buses require fuel, maintenance, trained drivers, parking lots to house them, insurance, and upgrades to keep the fleet current.

It is the same with technology. The continuing operational costs of maintaining and using the technology dwarf initial purchase and installation costs. These costs include: payments to utility and Internet service providers; technical support; instructional content; renovations to the physical plant; trained educators and administrators; and upgrades as newer equipment comes on line.

Too often educational institutions have focused on startup costs without planning for the substantial and continuing costs of opera-

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tion. When this occurs, technology, like unused buses, is relegated to the "garage" and has little value to anyone.

Schools and colleges are beginning to adopt "total cost of ownership" (TCO) models that have been used for years by the business community.[1] This approach breaks down into component parts each of the expenses involved in using technology so they can be more clearly analyzed. For example, Quality Education Data (QED) reports that K-12 schools spent an average of $122 per student on technology support during the 1998-99 school year. QED broke down the average TCO in the figure shown on the following page.[2]

Local Budgets Vary, but Patterns are Consistent

The amount that K-12 districts spend on school technology and Internet access varies. A 1998 survey[3] of 29 large urban school districts found that technology budgets ranged from $22 per student to $584 per student. The average hovered in the $120 to $130 range per student. Most financing models indicate that the initial costs of hardware purchases and installation, along with retrofitting of old buildings to support an upgraded infrastructure, represent the bulk of costs when amortized over five years. It is assumed that costs then shift to non-capital, or operating expenses. But in reality, K-12 technology expenditures skew heavily on the side of hardware. A survey of 400 district and school level officials found that schools were spending 55 percent of total costs on hardware, 16 percent on networking, 9 percent on software, and only 6 percent on training, with another 6 percent on service and support, 5 percent on supplies, and 1 percent on online services.[4]

What seems clear is that schools are under-investing in the personnel and support needed to make their technology investments most useful. In some ways this is a result of the way technology is funded in schools and colleges. Technology startup costs have often been funded with capital dollars raised by bond issues and special grants that may be easier to raise than the continuing operating funds required for ongoing costs. Yet it is these continuing service and personnel costs that are often most critical to technology integration in an educational environment.

Patterns of Education Funding

Education for America's elementary and secondary schools is primarily the responsibility of states and localities. The funding follows this pattern.

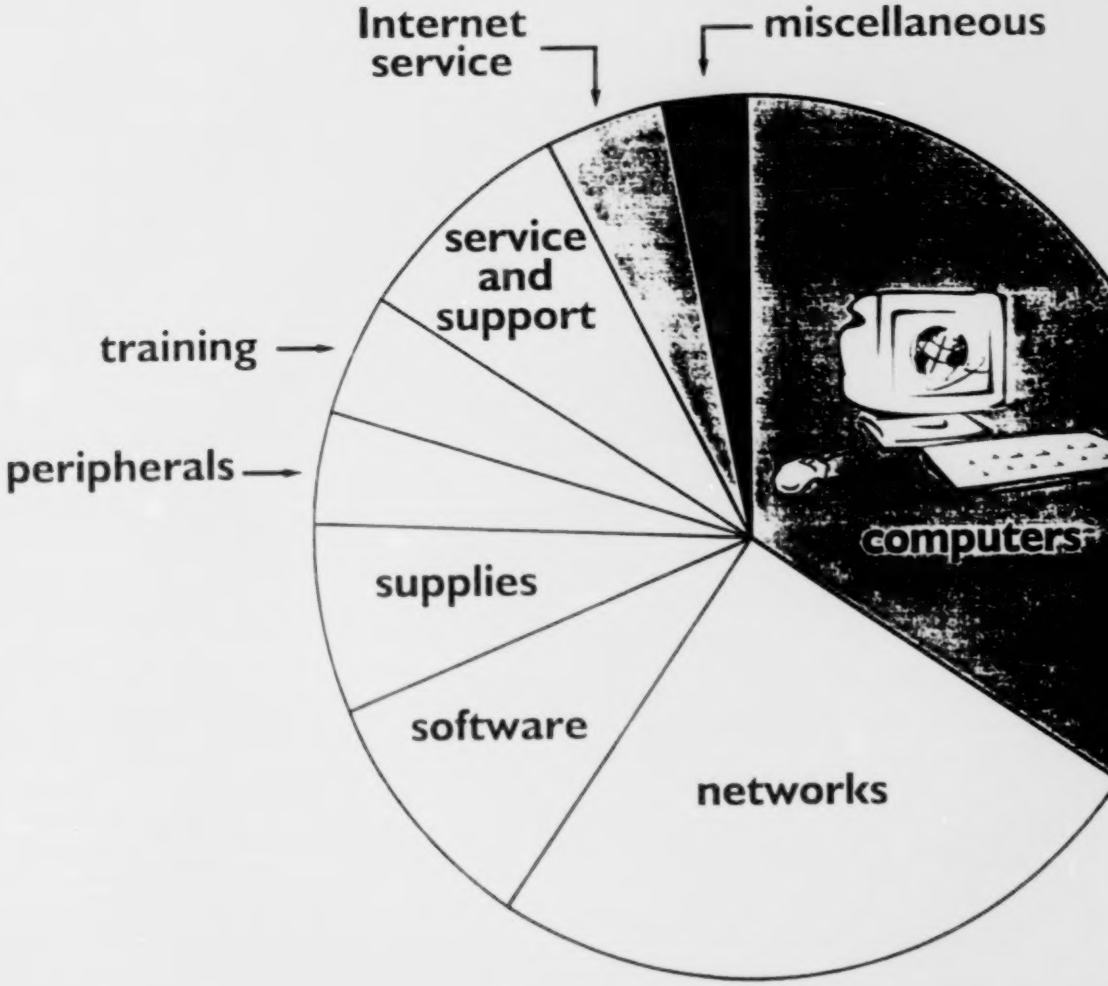
States provide approximately 44 percent and localities close to 40 percent of the nation's expenditures for elementary and secondary education, while foundations, in-kind activities and others sources provide 10.2 percent of funding. The federal government currently contributes only 6.1 percent of all elementary and secondary education funds.[5]

The federal share of education funding overall has declined, from 13.9 percent in fiscal 1980 to 6.1 percent in fiscal 1998. This declining federal funding share is also true for higher education, where the federal share was 18 percent in fiscal 1980 and dropped to 12.1 percent in fiscal 1998.

Nonetheless, there are areas where federal dollars have a major impact.

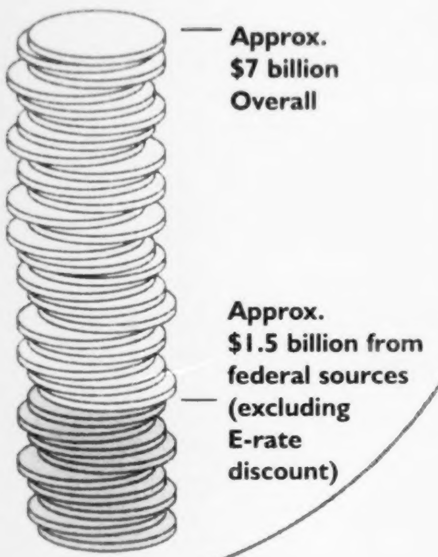
The federal government has made a large-scale investment in the future through its support of technology at the K-12 level. Estimates place the current federal share of education technology investment at about $1.5 billion, or between 20 percent and 35 percent of all elementary and secondary technology outlays.

TOTAL COST OF OWNERSHIP (TCO)



Federal Funding for Technology—Targeted and General[9]

FEDERAL SHARE OF EXPENDITURES ON TECHNOLOGY AT THE K-12 LEVEL



The $1.5 billion federal funding for education technology comes from both targeted programs for technology as well as via core or "traditional" federal programs. In the former category of direct education technology programs are the Technology Literacy Challenge Fund funded at $425 million in fiscal 2000 as well as the Technology Innovation Challenge Grant program for stimulating technology-supported high performance learning environments, funded at $146 million in fiscal 2000.

Other **specialized technology programs** include:

- **Preparing Tomorrow's Teachers to Use Technology (PT3)—funded at $75 million in fiscal 2000**
- **Community-based Technology Programs—$32.5 million**
- **Stars School Program—$50.5 million**
- **Learning Anytime, Anywhere Partnerships—$23.3 million**
- **Technology and Media Services—$36 million**
- **Assistive Technology for the disabled learner—$34 million**

An even greater portion of federal education technology funding support comes through **core federal programs** which have made school hardware and software acquisition, as well as staff development for technology, a greater priority in recent years.

These include:

- **Title I grants for basic and advanced skills—Approximately $500 million of this $8 billion annual program is used by schools to support technology investment. Title I provides almost a third of all software and hardware used in basic skills instruction in schools.**

- **Title VI Innovative Education Strategies—Approximately $125 million to $150 million a year is spent on upgrading technology in schools.**

- **Title II Eisenhower Professional Development—With total funding in fiscal 2000 of $335 million, this program places a priority on teacher training with technology, and allows low-income schools to use all Eisenhower funds for hardware and software purchases.**

- **Goals 2000 Educate America Act—Fiscal 2000 funding is $491 million. A large portion of these funds is spent by states and school districts on technology planning.**

- **Vocational and Adult Education—School districts use approximately $250 million for technological capacity building.**

In addition to the federal investment in education technology, states and school districts contribute another $5.4 billion for instructional technology via a myriad of district-wide programs and competitive grants.[10]

Telecommunications Funding: Intersecting State and Federal Responsibility

Missing from these amounts, however, is funding for telecommunications access made possible through the E-rate program.

Enacted as a part of the Universal Service Program of the Telecommunications Act of 1996, the E-rate program provides discounts to public and private schools, libraries, and consortia on the costs of telecommunications services, internal access, and internal networking. In the program's first two years, tens of thousands of public and private elementary and secondary schools, and thousands more libraries received a total of $3.66 billion in discounts on connectivity and telecommunications services.[11] In the Spring of 2000, the Federal Communications Commission announced that the third year of the program would be funded at $2.25 billion, the maximum allowed, based on requests submitted by schools and libraries around the country.

Telecommunications and education policy present an intersection of state and federal responsibility. The federal telecommunications funding mechanism that provides universal service offers a basic level of service to individuals regardless of where they live. This subsidy is in effect an "equal opportunity access guarantee" that applies equally to individuals wherever they live.

The E-rate sits at the intersection of this juncture, as it was developed on the belief that the Internet should provide a place where all learners can find information and opportunities for anytime, anyplace learning. The funding subsidy it provides is leveling the Internet playing field for education.

Technology Investments Can Lead to Economies of Scale and Real Productivity Gains

In this new environment, two things are clear: funding must be sustained, and new approaches must be considered. Old models do not meet new realities. It makes little sense to use 30-year bonds to purchase equipment that should be replaced in 3 years.

Schools should examine how technology costs in one area can be offset by efficiencies in other areas. The productivity gains found in business through investments in technology took 3 decades to emerge. Today these investments are considered a foundation of the U.S. economy, accounting for a third of our growth.[12]

Similar growth in educational productivity might be derived through technology, but only if other changes are adopted that support more productive educational environments. Streamlining administrative procedures is an obvious example. Web-based test administration could bring significant cost savings in assessment expenditures.[13] Likewise, savings in textbook and instructional materials budgets may be achieved if the licensing, distribution, and updating of these are made less expensive online. Teacher training online may be a more efficient use of time and resources than paying for substitutes when teachers are pulled away from their classrooms.

But if technology is used as an add-on to existing activities, rather than as a means to reshape education, then it will simply add to the total cost of operations and few savings will be realized. Business has learned that productivity gains and cost savings come only when old ways of doing business are abandoned and technological solutions replace them. For example, when universities can reach students through online courses, they can reevaluate their budgets for building more "bricks and mortar" campuses.

> "The U.S. classroom is a 150 year-old, relatively low-cost technology, worn out by time and changed conditions for meeting these requirements."
>
> (e-Testimony, Arthur Melmud, August 21, 2000)

There is nothing magical about traditional classroom practice. Educationally, students require a mix of pedagogical support, guidance, and supervision, which can be provided in a myriad of ways. The U.S. classroom is a 150 year-old, relatively low-cost technology, worn out by time and changed conditions for meeting these requirements.[14]

Perhaps the much sought after Internet "killer" application for education is not an application at all, but the potential for reorganizing education and for connecting communities of students, teachers, parents, and highly qualified volunteer experts.[15]

While we do not suggest replacing the classroom teacher with technology, we should consider how we could do more with the teachers we have. Investing in the development and support of skilled teachers, and supplementing the expertise of a given teacher with the distributed expertise of the broader education community, offers great promise. The possibility of making "the best and the brightest" of the teaching profession available to learners in places where accidents of geography and economics have led to lower quality educational experiences suggests that the Internet can impact the economics of education in ways we have only just begun to imagine.

A number of witnesses[16] offered a range of funding model proposals that might address the continuing technology requirements of the education sector. These suggestions fall into the following categories:

- **Tax incentives to encourage educational investments in areas of high cost and high need**
- **User taxes on corporate technology purchases**
- **Public and private partnerships in building and renovating schools to provide high tech centers an entire community can use during non-school hours, supported through user fees**
- **Increased federal and state appropriations for technology and web-based learning opportunities**
- **A learning technology trust fund that could combine these models to help sustain long-term school technology investment momentum**

Good Education is Good Business

Business should play a much larger role in helping schools make technology support their educational needs. Business depends upon the graduates of our nation's educational system. We should not have to rely so strongly on annual increases in the number of visas granted to highly skilled technology workers to supply the U.S. workforce. All businesses—not just high tech companies—have a substantial stake in this area. Banks and retailers, food and beverage companies, and clothing manufacturers all need employees with greater technical capabilities than our schools are currently providing to fill the high-skilled jobs necessary in today's economy. Isolated donations of hardware or software, while potentially helpful, are simply not enough.

Aggregating the e-learning Market[17]

Content, equipment, and services costs associated with web-based technologies can be brought down in several ways. Aggregated purchasing would enable suppliers to lower their per unit prices. Many states already purchase technology by aggregating demand, and some state and district education systems are joining in. (See, for example, the Digital Dakota network described earlier in this report.) But more could be done to capture potential economies of scale throughout the education sector.

The development of standardized education technology packages (e.g., hardware, software, training, service support, online content, and Internet services) helps build significant volume to purchases. By making these packages modular and scalable, schools could select appropriate technology and network components at the lowest cost and most effective price point.

Other costs include time spent in planning, installing, managing, and upgrading systems. Some institutions have found that hardware, software, and services integrated into packages suitable for different needs and circumstances takes much of the complexity out of planning multimedia network computing installations. Remote management of local school networks can ultimately remove the need for expensive onsite technical personnel, as well as provide higher quality service.

The use of existing internationally recognized standards such as Internet protocols, and the development of additional standards, have the potential of creating packages with enormous market demand, attracting suppliers to the education market, and promoting competition in price and capabilities. This type of standardization, quite common in other areas served by technology, could help lower prices and improve performance in education as well.

The development of an efficient network architecture can also help build economies of scale. Designing multi-user/use platforms means that more value can be obtained from hardware and service configurations. Careful network and communications backbone architecture is critical to lowering communications costs. The backbone architecture issues go beyond the design and management capabilities of any school district, but collaborations could be as cost-effective for education as such networks are in other areas. State networks that are in place and ready to link to the Internet2 backbone could offer the most technology access for the dollar.

Meeting the Challenge

In many cases, the use of networked computing will enable schools to significantly revamp and modernize their educational programs. Opportunitie[illegible]o expand individualized learning, provide access to a much broader and richer set of educational materials and human resources, and promote "learning-to-learn" skills will often require changes in how our educational institutions are organized and funded. If schools and universities are to be held accountable for improving educational outcomes based on the investments made using technology, they will need help from government, business, and public sector partners at all levels.

There are no technical reasons why we cannot make the benefits of web-based education available to everyone; it is simply a matter of our will. The choices we make in terms of organizing and funding will determine who benefits and how quickly. As a nation, we must set goals of making web-based education networks quickly and universally available, affordable, practical, and effective in improving educational outcomes.

A CLASSROOM THAT KEEPS UP WITH MIGRANT KIDS

Maria Martinez, Deysi Salazar, and Anabel Salazar, 16-year-old cousins, worked last summer thinning and hoeing sugar beets in Sidney, Montana. After the work was finished in Montana, they and their families headed to Kittitas, Washington, where they harvested potatoes until mid-November. Sidney and Kittitas are a long way from Del Rio and Eagle Pass, Texas, where the girls are enrolled in school. And the grind of working in the fields from 6 a.m. to 4 p.m. is a long way from the summer and daily school activities of many of their classmates.

Still, against all odds, Maria, Deysi, and Anabel expect to graduate from high school, and to have a life that is vastly different from that of their parents.

They have this chance because they can work toward high school diplomas on laptop computers provided by ★ESTRELLA,[1] an ambitious effort that unites the power of the Internet, the commitment of educators and parents, and the desire of students to reach academic goals while contributing to their family as workers. (Estrella is the Spanish word for star. The acronym stands for Encourage Students Through Technology to Reach High Expectations in Learning, Lifeskills, and Achievement.)

Funded by the U.S. Department of Education's Office of Migrant Education and strengthened by a strong network of collaborating partners, ★ESTRELLA is focused on expanding opportunities for migrant students. "The purpose is to get kids graduated," says Robert Lynch, coordinator for the New York State component of the project. By the end of the 1999-2000 school year, 90 students had completed 148 courses and earned credit, and 17 had graduated. An additional 11 graduates are anticipated by summer of 2001. The overall dropout rate for kids in migrant families is over 50 percent in traditional school programs.

Students in the project are enrolled in a Texas high school or middle school and travel with their families to one of the three "receiving" states: Illinois, Montana, or New York (Minnesota is being added this year). Students sign a contract to devote at least 7 hours a week to their classes. Their parents commit to support the students and to try to create an environment conducive to studying. Because traveling families live in crowded and ramshackle housing, usually in migrant camps, finding a good place to study is not easy. Project staff members help kids find locations to connect their laptops, perhaps a school or library, or sometimes a phone line in their camp.

With the laptops, students are able to access courses from the Texas High School curriculum, available through NovaNET. All NovaNET work is monitored via modem by the project

Interstate Student Coordinator and NovaNET lab teachers. The system tracks each student's work and maintains data on lessons attempted and completed, as well as assessments taken.

Satisfactory course completion means credit for each student in their home-base school district. Prior to graduation, each student also must pass the Texas Assessment of Academic Skills (TAAS). The TAAS preparation and practice tests are also available on the NovaNET system.

An Internet connection and an individual Yahoo account enable students to e-mail teachers, mentors, friends, and the ★ESTRELLA Interstate Student Coordinator. They can also visit many Internet learning sites. The laptops have become the focal point of many families, giving the older children a way to earn credit, younger children exposure to technology in their home, and parents a way to learn English, acquire basic skills, and study for general education diplomas.

Educators and migrant worker support staff in each state provide support and encouragement for students participating in ★ESTRELLA. Additionally, "cyber mentors," college students enrolled at the University of Texas-Pan American, provide encouragement and guidance about entering college. Cyber mentors come from a background much like the ★ESTRELLA students they work with. They also serve as role models, offering reminders about the importance of completing course work and passing on tips about planning ahead.

Cyber mentors share their own experience of leaving the extended family for the first time and taking the big step to higher education. One weekend each year, ★ESTRELLA students travel to the university campus to meet their cyber mentors in person and experience the world of college life.

In addition to NovaNET, ★ESTRELLA has a private-sector partnership with the Polaroid Education Program, which has developed a Visual Learning program. Students use both instant and digital cameras, learn to define and refine images, and then use the images as a basis for improving language and communication skills. Students contribute to a newsletter, strengthening their language capability and sharing experiences.

★ESTRELLA's annual budget is $400,000. The level of investment has been criticized by some, questioning the dollars spent on technology versus increased instruction by teachers. The project leaders, all veteran migrant educators, refute this criticism. True, technology is the link, but most of the budget goes towards assuring that children receive considerable one-on-one support, including work with their parents. "It costs money, but it changes their lives," says Angela Branz-Spall, Montana Director of Migrant Education. "We decided to make a real difference, one child at a time."

Brenda Pessin, Project Director, has seen this project work for migrant children and is committed to the vastly expanded opportunities it creates for them. "Maria, Deysi, and Anabel, and the other ★ESTRELLA students are stars in the eyes of the project," she says. "More importantly, they are stars in their own eyes."

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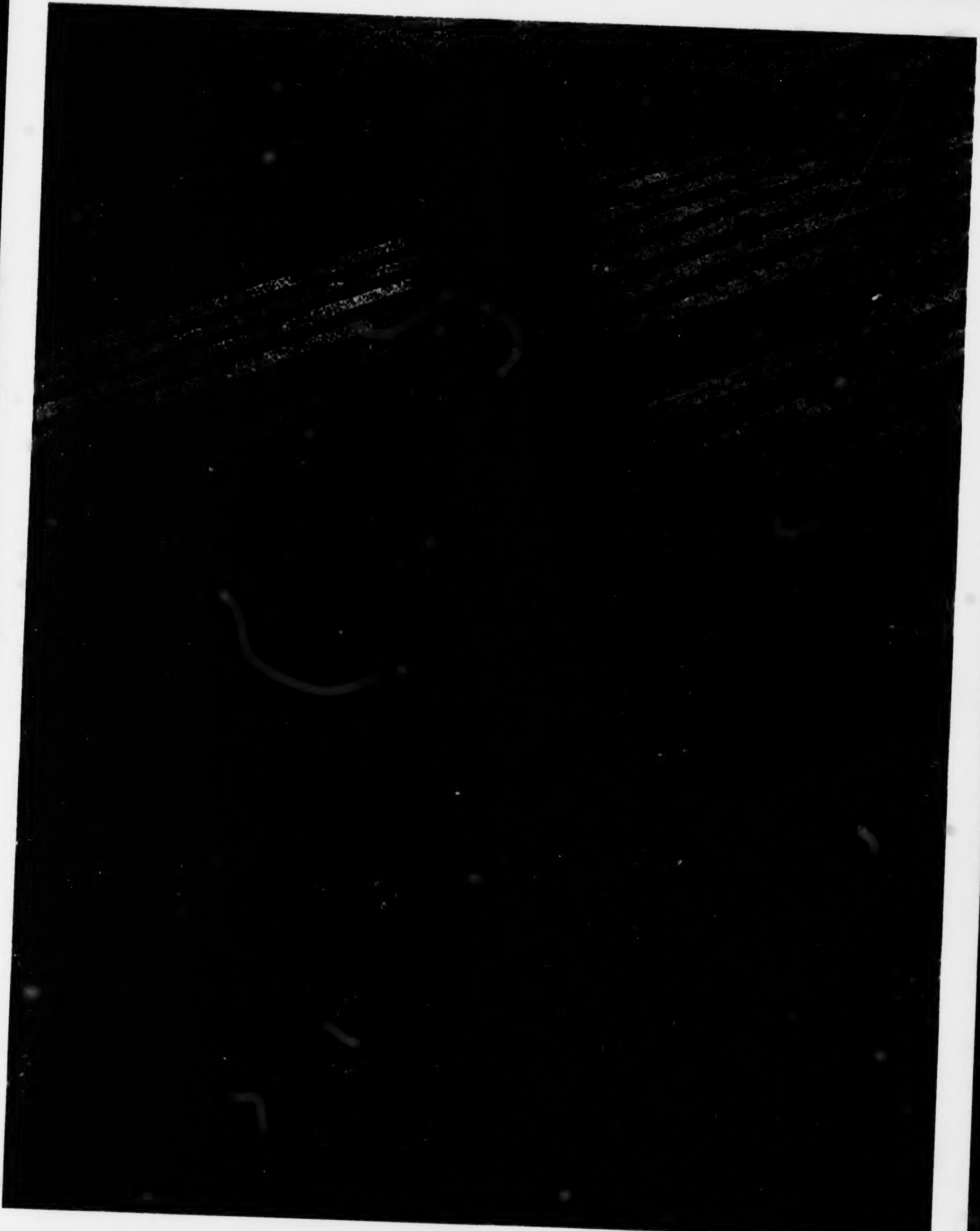

MOVING FROM PROMISE TO PRACTICE

A CALL TO ACTION

The question is no longer *if* the Internet can be used to transform learning in new and powerful ways. The Commission has found that it can. Nor is the question *should* we invest the time, the energy, and the money necessary to fulfill its promise in defining and shaping new learning opportunity. The Commission believes that we should.

The issue before us now is *how* to make good on the Internet's promise for learning. It is time we support education's new trailblazing heroes. It is time we collectively move from promise to practice.

Based on the findings of this report, the Web-based Commission believes a national mobilization is necessary, one that evokes a response similar in scope to other great American opportunities—or crises: Sputnik and the race to the moon, bringing electricity and phone service to all corners of the nation, finding a vaccine for polio.

The very idea of the World Wide Web is one of connections. Our ability to use the Internet to reshape learning requires actions that are also interrelated and interconnected. The Commission saw first-hand the policies that most influence technology use in education derive from bottom-up, interconnected grassroots efforts far more than from top-down dictates. The nation needs to tap into this energy and use it to shape education policy for the Internet age.

The nation should embrace an "e-Learning" agenda as a centerpiece of our federal education policy.

The idea of connectedness also applies to the reality of our current learning environment. The core barriers to effective Internet use identified by the Commission cannot be addressed in isolation. They are inextricably linked. As such, they pose an even greater challenge that can be resolved only through a widespread mobilization effort.

That effort, therefore, must work to assure:

- **Universal broadband access at home, at school, and at work in support of learner-centered, anytime, anywhere, any pace educational opportunity**
- **High quality, on-demand, and continuous professional development and support for educators and administrators at all levels**
- **A new education research agenda that is well-funded and focused on how people learn in the Internet age**
- **Online educational content that is widely available, affordable, and meets the highest standards of educational excellence**
- **Relief from regulatory and administrative requirements that do not accommodate innovations in learning**
- **Reliable safeguards to protect online learners and ensure their privacy**
- **Sustained funding—via traditional and new sources—that meets the challenge of learning transformation**

These are difficult challenges, but working together, we can overcome them.

The Congress and Administration can seed the field, taking the lead by reviewing and adapting education and telecommunications law and regulations to reflect, incorporate, and support new designs and advances in web-based education and innovation.

States, which traditionally have the most considerable impact on the conduct of education at all levels, can initiate a new era of collaboration with each other and their educational institutions and local districts.

Communities and the Private Sector can build new powerful partnerships leading to innovative designs in learning services and applications that meet high standards for quality, ease of use, and cost efficiency.

A National Call to Action

The bipartisan, congressional Web-based Education Commission calls on the new Congress and Administration to embrace an "e-learning" agenda as a centerpiece of our nation's federal education policy.

This e-learning agenda should be aimed at assisting local communities, state education agencies, institutions of higher education, and the private sector to maximize the power of the Internet for learning.

In the next two years, the 107th Congress and new Administration are required to revise the major laws guiding federal involvement in K-12 education. The reauthorization of the Elementary and Secondary Education Act will, in large part, determine federal education priorities and the tens of billions of spending that go with them for the next five years. Congress and the Administration will also consider new funding authority for education research. They are likely to revisit the issues of safeguarding children online, copyright law in the digital age, advertising in education, and other "rules of the road" issues related to the Internet. Finally, Congress and the Administration will begin preparations for revising the student financial assistance laws as part of the reauthorization of the Higher Education Act.

The opportunity has never been better for establishing meaningful public policy aimed at maximizing the power of the Internet for learning as a fundamental element of education at all levels. We urge the Congress and President to seize this opportunity and to focus on ways in which these public laws can be modified and changed to support, rather than undermine, the technology that is so dramatically changing education.

We call on federal and state governments to make the extension of broadband access for all learners a central goal of telecommunications policy.

We urge federal and state policymakers to adopt a policy framework that will help accelerate broadband deployment in education quickly and effectively. The E-rate program, which has brought 21st Century telecommunications into the nation's schools and libraries, has provided a dramatic boost. Individual state efforts have shown promise and success. Policymakers in state and local jurisdictions should consider complementary efforts focused on educational applications of broadband access.

Federal and state policymakers should also consider legislative changes designed to achieve speedy deployment of broadband technologies at our nation's educational institutions, particularly for those communities of learners on the other side of the "Digital Divide." Better collection of data on current access levels, costs, and availability of broadband services around the nation will facilitate this goal.

Greater Internet access for education enables the private sector to build the base of skilled workers it needs to operate in the global economy and to expand its market for enhanced telecommunications goods and services. This opportunity brings with it responsibilities for helping to build and support this capacity. Policymakers should seek out new partnership opportunities focused on high quality services, affordable rates, and sustained upgrades and improvement in access.

We call on policymakers at all levels to work with educational institutions and the private sector to support the continuous growth of educators through the use of technology.

Educators are the ultimate knowledge workers. We know that more and different training will be necessary if teachers, administrators, and faculty members are to integrate the advances of technology into the curriculum and into their teaching. To do so will require a major new direction and commitment from policymakers, from the private sector, and from educators themselves.

Congress has begun to focus on building the institutional capacity to assure that the next generation of teachers uses technology as effortlessly and effectively as workers in other industries. We encourage continuing support for these efforts, along with initiatives and models that make just-in-time, just-what's-needed training and support available to educators. The reauthorization of the Elementary and Secondary Education Act offers the opportunity to make this happen and to incorporate the best thinking and practices identified by this Commission. In addition, the Higher Education Act reauthorization down the line will provide another vehicle to articulate the federal role in professional development.

Partnerships that bring together the federal government, state and local agencies, the private sector, and educational institutions offer the promise of assuring continuing teacher empowerment and growth with technology. Federal funding through such important efforts as the Preparing Tomorrow's Teachers for Technology program primes the pump for these collaborations.

States can share in the development and distribution of e-learning courses, programs, and materials for teacher education and professional development. They can also work together to adopt common frameworks for building the competencies and performance assessments of new teacher expertise and build policies that allow for cross-state teacher certification.

The nation's universities, and the colleges of education within them, should make the development of highly skilled 21st Century educators their most important priority; and they should fund and support teacher and administrator preparation programs accordingly.

We call upon the Federal government to create a comprehensive research, development, and innovation framework for learning technology.

A commission appointed in 1997 by President Clinton (the President's Commission of Advisors on Science and Technology) called for a rigorous empirical research program at a level equal to at least 0.5 percent of the nation's aggregate spending on K-12 education. This has not happened and with the passage of time the urgency of this goal is even more critical.

To achieve this goal, the Commission recommends:

- Establishing a benchmark goal for federal R & D investment in web-based learning, consistent with similar benchmarks in other industry segments. A possible approach could be the creation of a "Synergy Superfund," a continuous funding source to advance necessary public-private partnerships to build the fast turnaround of technological breakthroughs with applications for learning.

- Focusing on high payback targets of educational opportunity where present links between learning theory and technological innovation appear particularly promising. These include such areas as new forms of assessment of learning, early reading content, and the conceptual stumbling blocks that impact understanding and achievement in mathematics and the sciences.

- Supporting the creation of learning communities and tools for collaborative knowledge building and dissemination among researchers, teachers, and developers. Funding and regulatory support for public-private partnerships, and cross-institution and cross-agency collaboration in R & D could make it possible to bring promising ideas to practice quickly and efficiently by using the Internet as a research and dissemination tool.

- Supporting a sustained effort to track the use of the Internet in education and how the Web is transforming learning. A particular focus should be on the effectiveness of the policy actions implemented to address the key barriers to web-based education.

We call upon the public and private sectors to join forces in developing high quality content and applications for online learning.

There is an increasing body of good content for e-learning, but it presents only a small glimmer of what is possible. And it is difficult for the consumer to sort the wheat from the chaff, to make sense of all the "clutter" on the Web. Compounding this problem is a risky private capital market for development, particularly at the preK-12 level.

At the federal level, the Commission recommends that:

- Congress articulate content development priorities and seed funding for development of web-based content and applications in high need areas (e.g.; adult literacy; English as a second language; and teacher preparation). It should also encourage collaboration and partnerships between the public and private sectors in the development and distribution of high quality online courses, learning tools, and materials.

- Federal agencies and programs should adopt technical standards for the design of online courses and the meta-tagging of digital content. These should include universal design standards for access for those with disabilities.

For the education community, the Commission recommends:

- Continuing the current voluntary system of accrediting higher education institutions and programs. However, the range of programs and new providers suggests the need for better clarity for the consumer regarding what accreditation means. The joint development of a "consumer's guide to accreditation" by the federal government and the higher education community would be an important contribution.
- Creating mechanisms for users to share their commercial and noncommercial resources and experiences regarding online courses and programs. Experimentation with online user reviews for content similar to that found on commercial sites (e.g., Amazon.com) could empower the informed choice of educators.
- Articulating frameworks for what constitutes good online courses and encouraging private sector education providers to develop their courseware in concert with these frameworks.

For the states, the Commission recommends convening state and regional education accreditors and organizations to build common frameworks and requirements for online learning programs, courses, and certifications comparable to those required for onsite programs.

We call on Congress, the U.S. Department of Education, and state and regional education funding and regulatory authorities to remove barriers that block full learner access to online learning resources, courses, and programs while ensuring accountability of taxpayer dollars.

Witnesses spoke forcefully and effectively about how federal, state, and local education regulations written for an earlier education system no longer work in today's borderless, timeless "anywhere, anyplace" learning environment.

There are some areas where federal action may be appropriate. The Commission recommends a full review and, if necessary, a revision of the 12-hour rule, 50 percent rule, and incentive compensation requirements that are creating barriers to students enrolling in online and distance education courses. We call on the Department of Education, Congress, the higher education community, and the private sector to continue to work together in devising alternatives for measuring student financial assistance eligibility to accommodate online learning opportunity.

The Commission also encourages states to:

- Work with organizations such as the National Governors' Association, the National Conference of State Legislatures, the Education Commission of the States, the Council of Chief State School Officers, the State Higher Education Executive Officers, and the National Association of State Boards of Education to convene and provide incentives for collaboration among educators, content providers, and regulators that span state or regional boundaries.

- Recognize and support efforts to increase cross-state regulatory and administrative cooperation modeled after the Southern Regional Education Board and the Western Interstate Cooperative in Higher Education. Such efforts should be encouraged to develop policies that address the transfer and awarding of academic credit earned online; faculty workload, compensation, and online content ownership issues; financing of distance learning; quality assurance in distance learning; online student services (e.g.; library resources, admissions, advising); and programs that reach underrepresented student populations.

The Commission endorses the U.S. Copyright Office proposal to convene education representatives and publisher stakeholders in order to build greater consensus and understanding of the "fair use" doctrine and its application in web-based education. The goal should be agreement on guidelines for the appropriate digital uses of information and consensus on the licensing of content not covered by the fair use doctrine.

We call upon the education community and parents, working with the private sector, to develop and adopt appropriate privacy and protection safeguards to assure that learners of all ages are not exploited while participating in learning activities.

Because of the open nature of the online learning environment, there will always be some risk. To minimize this risk, efforts should be made to help schools, districts, and parents come to reasonable solutions that protect vulnerable individuals while encouraging the positive exploration the Web makes possible.

The Commission believes that filtering and blocking software alone is of limited value in this regard. Instead, the Commission recommends:

- Encouraging developers and educators to collaborate in creating noncommercial, high quality educational zones that could be easily accessed by educators, parents, and children.

- Promoting efforts involving states, districts, and schools that will result in education programs that empower students to use the Internet safely, wisely and ethically. Educational programs should be built around appropriate use policies that set clearly understood and locally derived standards. These programs should reach out beyond students and include parents, teachers, and administrators.

The Commission believes that the Children's Online Privacy and Protection Act (COPPA) provides important protections for young children. Nevertheless, all students, especially teenagers not covered by COPPA, need to understand threats to privacy and the implications of inappropriate disclosure of information. The education market should speak with one voice in demanding that young people and their families have access to information already collected and the opportunity to correct, prevent, or curtail the use of their personal information.

We also have seen that, if the Web is to be used to its fullest powers for personalized, interactive learning, the collection of some identifiable student information online may be necessary. Parental permission may be better directed as an "opt-out" rather than "opt-in" requirement for student participation in online learning activities. This suggests that some adjustments to COPPA may be necessary to allow educational exemptions from current verifiable parental consent requirements.

Finally, we call on the federal government, states, localities, and the private sector to adequately fund web-based learning opportunity.

The Commission encourages the Congress and Administration to consider several options brought before us that could provide sustained funding for web-based education. These could include: tax incentives to encourage educational investments in areas of high need and high cost in order to provide affordable capacity; additional public-private partnerships between education institutions, the public sector, and business; increased federal and state appropriations; and the creation of a learning technology trust fund to sustain momentum in web-based learning opportunity over the long-term.

The Commission encourages local and state education agencies to aggregate their market strength in order to bring advanced broadband technologies to preK-12, postsecondary, and adult education at considerably lower costs. We also believe that states can encourage deployment of broadband access through their support of similar tax incentives and targeting of funding in high-need areas.

In addition, states have a special opportunity to create and fund networks that can be linked to the Internet2 backbone and bring state-of-the-art technology applications to educational institutions.

The question is no longer if the Internet can be used to transform learning in new and powerful ways. The Commission has found that it can. Nor is the question should we invest the time, the energy, and the money necessary to fulfill its promise in defining and shaping new learning opportunity. The Commission believes that we should. We all have a role to play. It is time we collectively move the power of the Internet for learning from promise to practice.

Appendices

A. Commission Legislative Authority

B. Commission Meetings

C. Commission Hearings and Witnesses

- February 2-3, 2000, Washington, DC
- April 7, 2000, Palo Alto, California
- June 26, 2000, Atlanta, Georgia
- July 19-20, 2000, Washington, DC
- September 14-15, 2000, Washington, DC

D. e-Testimony Submissions to the Commission

E. Commission Speeches and Presentations

F. Stakeholder Meetings with Commissioners and Staff

G. Individuals and Groups Providing Services to the Commission

- Contributors
- Contractors

H. Commission Staff

COMMISSION LEGISLATIVE AUTHORITY

AUTHORITY

The Web-based Education Commission (Commission) is established by Section 852 of the Higher Education Amendments Act of 1998 (P. L. 105-244), as amended by the Departments of Labor, Health and Human Services, and Education, and Related Agencies Appropriations Act of 2000 (P. L. 106-113). The Commission is governed by the provisions of the Federal Advisory Committee Act (FACA) (P. L. 92-463, as amended; 5 U.S.C.A. Appendix 2).

PURPOSE AND FUNCTIONS

Pursuant to section 852 of the Higher Education Amendments Act of 1998, the Web-based Education Commission is established in the Department of Education's Office of Postsecondary Education, Office of Policy, Planning and Innovation. The Commission is established for the purpose of conducting a thorough study to assess the educational software available in retail markets for secondary and postsecondary students who choose to use such software. The Commission shall conduct public hearings in each region of the United States and prepare a report to the President and the Congress that contains recommendations regarding legislation and administrative actions, including those regarding the appropriate Federal role in determining quality educational software products.

Specifically, the duties of the Commission are:

1. The Commission shall conduct a through study to access the educational software available in retail markets for secondary and postsecondary students who choose to use such software.
2. As part of the study conducted under this subsection, the Commission shall hold public hearings in each region of the United States concerning the assessment.
3. To the extent practicable, in carrying out the study under this subsection, the Commission shall identify and use existing information related to the assessment.

STRUCTURE

The Commission is composed of sixteen members of which:

1. three members shall be appointed by the President, from among individuals representing the Internet technology industry;
2. three members shall be appointed by the Secretary, from among individuals with expertise in accreditation, establishing statewide curricula, and establishing information technology networks pertaining to education curricula;
3. two members shall be appointed by the Majority Leader of the Senate;
4. two members shall be appointed by the Minority Leader of the Senate;
5. two members shall be appointed by the Speaker of the House of Representatives;
6. two members shall be appointed by the Minority Leader of the House of Representatives;
7. one member shall be appointed by the Chairman of the Senate Health, Education, Labor, and Pensions Committee; and

8. one member shall be appointed by the Chairman of the House Education Workforce Committee.

Members shall be appointed for the life of the Commission. Any vacancy in the Commission shall not affect its powers, but shall be filled in the same manner as the original appointment. The Commission shall select a chairperson and vice chairperson from among the members of the Commission.

The Assistant Secretary for Postsecondary Education names the Designated Federal Official (DFO) to the Commission.

MEETINGS

Not later than 30 days after the date on which all members of the Commission have been appointed, the Commission shall hold its first meeting. Commission members shall meet at the call of the Chairperson, with the approval of the Designated Federal Official or designee who is present at all meetings. Meetings are open to the public except as may be determined otherwise by the Assistant Secretary of Postsecondary Education in accordance with Section 10(d) of the FACA. Adequate public notification is given in advance of each meeting. Meetings are conducted and records of the proceedings kept as required by applicable laws.

A quorum of the Commission consists of eight members. A lesser number of members may hold hearings.

ESTIMATED ANNUAL COST

Members will serve without compensation. However, members may each receive reimbursement for travel expenses incident to attending Commission meetings, including per diem in lieu of subsistence, as authorized by the Federal travel regulations. There is authorized to be appropriated $450,000 for fiscal year 1999 to the Commission. Any sums appropriated under the authorization shall remain available, without fiscal year limitation, until expended. The estimated annual person-years of staff support are two (2) FTE.

REPORTS

Not later than one year after the first meeting of the Commission, the Commission shall submit a report to the President and Congress, which shall contain a detailed statement of the findings and conclusions of the Commission resulting from the study, together with the Commission's recommendations:

1. for such legislation and administrative actions as the Commission considers to be appropriate; and
2. regarding the appropriate Federal role in determining quality educational software products.

The recommendations of the Commission may be submitted to the Secretary for comment prior to submission to Congress, but are not subject to review or approval by any offices in the Executive Branch.

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FOLLOW-UP REQUIREMENT

A report to the Congress one year after the Commission has made its final report, required by Section 6(b) of FACA, concerning the disposition of recommendations to the President contained in the report, will be prepared by the Office of Postsecondary Education.

TERMINATION

The Commission shall terminate on the date that is 90 days after the date on which the Commission submits the Commission's report to the President and Congress.

COMMISSION MEETINGS

Commission Organizational Meeting, Washington, DC	November 16-17, 1999
Commission Conference Call	January 6, 2000
Commission Conference Call	March 2, 2000
K-12 Working Group Conference Call	March 22, 2000
Higher Education Working Group Conference Call	March 23, 2000
Adult Education/Training Working Group Conference Call	March 24, 2000
Commission Conference Call	March 27, 2000
Web Site Design Meeting, Washington, DC	April 12, 2000
K-12 Working Group Conference Call	May 3, 2000
Higher Education Working Group Conference Call	May 4, 2000
Adult Education/Training Working Group Conference Call	May 5, 2000
Commission Conference Call	May 25, 2000
Commission Briefing at Georgia Institute of Technology, Atlanta, GA	June 26, 2000
Final Commission Meeting, Washington, DC	September 27, 2000

COMMISSION HEARINGS AND WITNESSES

February 2-3, 2000
The Internet and Education
Senate Dirksen Office Building
Washington, DC

Michael F. Adams, President, University of Georgia

Velma Cobb, Director of Education, Research and Policy, National Urban League

Honorable William M. Daley, U.S. Secretary of Commerce

Martha Dean, Superintendent, Wetzel County Schools, New Martinsville, West Virginia

Judith Eaton, President, Council for Higher Education Accreditation

Kathleen Fulton, Associate Director, Center for Learning and Educational Technology, University of Maryland

Doug Gorton, Student, Hunterdon Central Regional High School, Flemington, New Jersey

Larry Irving, President and CEO, UrbanMagic.com

Emily Judson, Student, Hunterdon Central Regional High School, Flemington, New Jersey

Neela Mookerjee, Student, Hunterdon Central Regional High School, Flemington, New Jersey

Sujay Pandit, Student, Hunterdon Central Regional High School, Flemington, New Jersey

Honorable Richard W. Riley, U.S. Secretary of Education

April 7, 2000
The Promise of the Internet to Empower Learners: Capturing the Perspectives of Technology Leaders, Policymakers, and Educational Experts
Sun Microsystems, Inc.
Menlo Park, California

Pauline Albert, Manager, Web Education Programs, Intel Corporation

Sheryle Bolton, CEO, Scientific Learning Corporation

John Brandon, CEO, Academic Systems/The Lightspan Partnership

Milton Chen, Executive Director, the George Lucas Educational Foundation

Toby Corey, CEO & Co-founder, Intend Change

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Honorable Delaine Eastin, Superintendent of Public Instruction, California

Warren Fox, Executive Director, California Postsecondary Education Commission

James Gibbons, Founder, SERA Learning Technologies

Tom Greaves, Co-founder & Vice Chair, NetSchools Corporation

Kenneth C. Green, Founder & Director, Campus Computing Project

Judith Hamilton, CEO, Classroom Connect

Robert Iskander, Director, Global K-12 Market, Sun Microsystems, Inc.

Kim Jones, Vice President, Global Education, Sun Microsystems, Inc.

Martha Kanter, President, De Anza College, California

Tony Lee, Senior Director, Worldwide Markets, Apple Computer, Inc.

Cheryl Lemke, CEO, Metiri Group (hearing facilitator)

Barbara Means, Co-director, Center for Interactive Technology in Learning, SRI International

Aaron Osmond, Director, Education Markets, Novell

Lou Pugliese, CEO, Blackboard, Inc.

Stuart Skorman, Founder & CEO, Hungry Minds

June 26, 2000
The Promise of the Internet to Empower K-12 Learners
National Educational Computing Conference
Atlanta, Georgia

Sasha Barab, Assistant Professor, Instructional Systems Technology, School of Education, Indiana University

Terry Crane, Vice President, Education Products, America Online, Inc.

Chris Dede, Professor & Head of the Education and Information Technology Department, Graduate School of Education, George Mason University

Elwood Addison (Buzz) Ellis III, President, McGraw-Hill Educational Publishing Group, The McGraw-Hill Companies

Carlene M. Ellis, Vice President & Director, Worldwide Education Programs, Intel Corporation

Dara Feldman, Early Childhood Instructional Technology Specialist, Montgomery County Public Schools, Maryland

Joan Fenwick, Director, AT&T Learning Network

Cari Ladd, Director, OnLine Education, PBS

Cheryl Lemke, CEO, Metiri Group (hearing facilitator)

Randy Pennington, Vice President of Sales, APEX Online Learning

Ken Reed, Technology Director, Alexandria City Public Schools, Virginia

John Richards, Senior Vice President & General Manager, Turner Learning, Inc.

Raymond Rose, Vice President, Concord Consortium

William L. Rukeyser, President, Learning in the Real World

Lynne Schrum, Associate Professor, Department of Instructional Technology, University of Georgia

Skip Stahl, Director, Professional Development, Center for Applied Special Technology

William Thomas, Director, Educational Technology, Southern Regional Education Board

John Vaille, CEO, International Society for Technology Education

Julie Young, Principal, The Florida High School

July 19-20, 2000
The Promise of the Internet to Empower Higher Education Learners
Senate Dirksen Office Building
Washington, DC

Donald Babcock, Provost & Vice President for Academic Affairs, Harcourt Higher Education, Harcourt Learning Direct

Mary A. Burgan, General Secretary, American Association of University Professors

Honorable Louis Caldera, U.S. Secretary of the Army

Judy Duffield, Program Coordinator of the Information and Learning Technologies Leadership Area of the Initial Teacher Education Program, University of Colorado-Denver

Honorable A. Lee Fritschler, Assistant Secretary of Postsecondary Education, U.S. Department of Education

Ellen Futter, President, American Museum of Natural History

Honorable William Goodling, U.S. Representative, Pennsylvania & Chairman, House Education and the Workforce Committee

Brian Hawkins, President, EDUCAUSE

Gerald Heeger, President, University of Maryland, University College

Nitza Hernandez-Lopez, Executive Director, Hispanic Educational Telecommunications System

Robert Manuel, Chief Information and Technology Officer, School of Continuing and Professional Studies, New York University

Jack McManus, Interim Dean, Graduate School of Education and Psychology, Pepperdine University

Jamie Merisotis, President, Institute for Higher Education Policy

Michael T. Moe, Director, Global Growth Research, Merrill Lynch

Laura Palmer Noone, Provost, University of Phoenix

Gerald R. Odening, Managing Director, Chase H&Q

Mary Beth Peters, Register of Copyrights, U.S. Copyright Office, Library of Congress

Pamela K. Quinn, Assistant Chancellor for Educational Telecommunications, Dallas County Community College District

Andrew Rosen, Chief Operating Officer, Kaplan, Inc.

Andrew Rosenfield, CEO, UNext.com

Patricia Schroeder, President & CEO, Association of American Publishers

L. Dennis Smith, President, University of Nebraska

Dorothy Cowser Yancy, President, Johnson C. Smith University

September 14-15, 2000
The Promise of the Internet to Empower Adult Learners
Senate Dirksen Office Building
Washington, DC

Amy Aidman, Research Director, Center for Media Education

Jane Baumgarten, Member, Board of Directors, AARP

Gary Beach, Group Publisher, CIO Magazine & Founder, Tech Corps

Jodie Bernstein, Director, Bureau of Consumer Protection, Federal Trade Commission

Bruce Bower, General Manager, LearningGate.com

John D. Bransford, Centennial Professor, Department of Psychology & Human Development, and Co-director, Learning Technology Center, Vanderbilt University

Hans Brisch, Chancellor, Oklahoma State Regents for Higher Education and Past President, State Higher Education Executive Officers

Honorable Conrad Burns, U.S. Senator, Montana and Co-chair, Congressional Internet Caucus

Gregory Cappelli, Director & Senior Analyst, Credit Suisse First Boston Corporation

Robert S. Christie, President & CEO, Thomson Learning

Katherine K. Clark, President & CEO, Landmark Systems Corporation and Vice Chair, 21st Century Workforce Commission

Daniel A. Domenech, Superintendent, Fairfax County Public Schools, Virginia

Honorable Calvin Dooley, U.S. Representative, California and Co-chair, House New Democrat Coalition

Honorable David P. Driscoll, Commissioner of Education, Massachusetts

Carolyn Elgin, President, Southwestern Indian Polytechnic Institute

Ira Fishman, CEO, HiFusion, Inc.

Larry Goldberg, Director, Media Access Group, WGBH Educational Foundation

Elizabeth L. Hacking, Senior Vice President, Strategic Development, Houghton Mifflin Company

Andy Hartman, Director, National Institute for Literacy

Randy J. Hinrichs, Group Program Manager, Learning Sciences & Technology Initiatives, Microsoft Research

Honorable William Janklow, Governor, South Dakota

Sally M. Johnstone, Director, Western Cooperative for Educational Telecommunications

Peter Jovanovich, CEO, Pearson Education

Honorable William Kennard, Chairman, Federal Communications Commission

Honorable Jeanne Kohl-Welles, Washington State Senate & Chair, Committee on Higher Education

Robert S. Lapiner, Dean of Continuing Education and University Extension, UCLA

Elliott Masie, President, The MASIE Center and Member, Advisory Commission on Training and Opportunities

Frank Mayadas, Program Director, Alfred P. Sloan Foundation

Jeanne C. Meister, President, Corporate University Xchange, Inc.

Jeff Munks, Chief Strategist, DigitalThink, Inc.

Joel Pate, Director, Eastern New Mexico Educational Resource Center

Linda Roberts, Special Advisor for Technology to the Secretary of Education and Director of the Office of Educational Technology, U.S. Department of Education

David Shaw, Chairman, D. E. Shaw and Co, Inc. and Juno Online Services, L.P., and Chairman, Panel on Educational Technology, President's Committee of Advisors on Science and Technology

Albert Siu, Chief Learning Officer, AT&T Corporation and Member, American Society of Training and Development and National Governors' Association Commission on Technology and Adult Learning

Judith S. Sunley, Interim Assistant Director for Education and Human Resources, National Science Foundation

Honorable Anthony Williams, Mayor, Washington, DC

Robin Willner, Director of Corporate Community Relations, IBM Corporation

Carol Vallone, CEO, WebCT

e-TESTIMONY SUBMISSIONS TO THE COMMISSION

Academy for Educational Development
AIM Lab, University of Illinois
Allegany Hope Welfare-to-Work Program, Allegany County, New York
Alliance for Childhood
Alyeska Central School, Juneau, Alaska
AMERICA 2000 Technology Innovation Challenge Grant Consortium
American Association of Colleges for Teacher Education
American Association of Community Colleges
American Association of Law Libraries
American Association of Museums
American Federation of Teachers
American Foundation for the Blind
American Library Association
America's Public Television Stations
Apple Computer, Inc.
Sousan Arafeh, American Institutes for Research
Arizona Learning Technology Partnership
Association for Supervision and Curriculum Development
Association of American Publishers
Association of Educational Publishers
Association of Research Libraries
Association of Tech Act Projects
Austin Independent School District
Thomas Barnwell, Georgia Institute of Technology
Donna Baumbach, University of Central Florida
Cheryl Bennett, International Ergonomics Association
Randy Bennett, Educational Testing Service
bigchalk.com
BlackCollege.com
Gina Boltz
Bonnie Bracey
Brigham Young University
Broward Community College
Dion Burn
Career College Association
Walter Carlson, Jr.
Robert T. Carter, Montville High School, Connecticut
CPB/WGBH National Center for Accessible Media
Center for Scientific Visualization
Central High School, Little Rock School District, Arkansas
class.com
Classroom Connect
Jon M. Clausen
Connecticut Distance Learning Consortium
Consortium for School Networking
Consumer Bankers Association
Convergence Mediagroup

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Cornell University
Corporate Vision Consulting
Council of Organizational Representatives on National Issues Concerning Deaf and Hard of Hearing Persons
CXO Media, Inc.
Distance Education and Training Council
Dow, Lohnes & Albertson, PLLC
DrPhysics.com
Eastern Catholic Alliance of Schools for Excellence
D. Eckert, Technology Education, Web-based Education
Education TurnKey Systems, Inc.
Educational Approval Board, Wisconsin
Educational Software Institute
Educational Support Systems
EduPoint, Inc.
eLearners.com, Inc.
Electronic Learning Communities, Georgia Institute of Technology
FamiliarTales, Inc.
Florida Gulf Coast University
Florida High School
Franklin University
FreeEdu.com
George Mason University
Georgia Institute of Technology Center for Distance Learning
Georgia Tech Research Institute
Georgia Youth Science & Technology Centers, Inc.
Madeline Gesslein
Allen Glenn, University of Washington
Global Schoolhouse at Lightspan.com
Global University System
Charles Grammick
Mary Halnon, Public Broadcasting Service
Hartford Gunn Institute
Higher Education Alliance for Information Technology
Hispanic Association of Colleges and Universities
John H. Huth
IBM Corporation
IBM Corporation Institute for Electronic Government
IBM Global Education Industry
Idaho State Board of Education
Ilisgavik College
Innovative Technology Center
Instructional Telecommunications Council
Integrated Technology Education Group, LLC
International Center for Advanced Internet Research
International Society for Technology in Education
Joel Jackson, Georgia Institute of Technology
Francis W. James, Sacred Heart College Senior School, Australia
JASON Foundation for Education
John Wiley & Sons, Inc.

Johns Hopkins University Center for Technology in Education
Richard Kahlenberg, Los Angeles Times
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Consortium for School Networking Annual Conference	Washington, DC	February 23, 2000
Software & Information Industry Association Annual Conference	San Diego, CA	March 12, 2000
Senate Education Technology Working Group Briefing	Washington, DC	March 17, 2000
Information Technology Industry Council Board Meeting	Washington, DC	March 17, 2000
The Blackboard Summit	Washington, DC	March 21, 2000
Office of Postsecondary Education (OPE) Agenda Project Briefing	Washington, DC	March 30, 2000
Higher Education Secretariat Meeting	Washington, DC	April 4, 2000
Association of Tech Act Projects Annual Meeting	Austin, TX	April 28, 2000
McGraw-Hill Summit	Washington, DC	May 2, 2000
Office of Postsecondary Education Agenda Project Meeting	Denver, CO	May 9, 2000
Senior Leadership Group, U.S. Department of Education Meeting	Washington, DC	May 15, 2000
The Association of Educational Publishers Annual Meeting	Washington, DC	June 8, 2000
Conference of Educational Administrators of Schools and Programs for the Deaf, Inc.	Rockville, MD	June 13, 2000
Office of Postsecondary Education/Brown Bag Luncheon	Washington, DC	June 14, 2000
National Coalition for Technology in Education and Training (NCTET) Legislative Meeting	Washington, DC	June 20, 2000
Council for Higher Education Accreditation Annual Meeting	Washington, DC	June 22, 2000
IBM Corporation Technology Briefing	Palisades, NY	June 23, 2000
National Education Association Annual Meeting	Chicago, IL	July 2, 2000

NCTET Summit on Assessment and Technology Lake Tahoe, NV	July 6-7, 2000
Education Commission of the States Annual Meeting Minneapolis, MN	July 12, 2000
Council on Law in Higher Education Annual Meeting Washington, DC	July 16, 2000
U.S. Department of Education Briefing for Associations Washington, DC	July 26, 2000
Minority Serving Institutions "Digital Divide" Meeting Washington, DC	August 4, 2000
International Council for Open and Distance Education Annual Conference Sao Paulo, Brazil	August 11-15, 2000
U.S. Department of Education International Conference on Technology Washington, DC	September 13, 2000
Southern Regional Education Board Technology Cooperative Meeting Pt. Clear, AL	September 20-22, 2000
InterAmerican Development Bank Meeting Washington, DC	September 21, 2000
Netherlands Delegation to the U.S. Department of Education Meeting Washington, DC	October 9, 2000
NCTET Legislative Coalition Meeting Washington, DC	October 10, 2000
Triangle Coalition for Science and Technology Briefing Washington, DC	October 13, 2000
Classroom of the Future Meeting University of Maryland, College Park, MD	October 14, 2000
Virtual High School Symposium Louisville, KY	October 17, 2000
OPE/Higher Education Association Meeting Washington, DC	October 19, 2000
America Online Education Foundation Briefing Washington, DC	October 19, 2000
Bertelsmann Foundation German-American Dialogue Gütersloh, Germany	October 22-25, 2000
American Educational Research Association Briefing Washington, DC	October 23, 2000
Digital Education Marketplace 2000 Conference Boston, MA	October 24, 2000

Center for Innovative Learning Technologies 2000 Meeting McLean, VA	October 24, 2000
National School Boards Association Technology and Learning Conference Denver, CO	October 25, 2000
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The Center on Education Policy Briefing Washington, DC	November 2, 2000
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IBM Corporation Technology Briefing Washington, DC	November 15, 2000
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Maryland Technology Showcase Baltimore, MD	December 6, 2000
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National Conference of State Legislatures Assembly on Federal Issues and Assembly on State Issues Joint Meeting Washington, DC	December 14, 2000

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